TABLE OF CONTENTS

I. General Description of the Industry: Page

1. Senate Document No. 61, 70th Cong., 1st Sess., Federal Trade Commission Report, *Petroleum Industry, Prices, Profits, and Competition*, pp. 6–9 and pp. 99–100 1–10
2. Table showing uses of fuel oil. (Department of Commerce, Bureau of Mines, Mineral Market Reports, No. M. M. S. 154, November 16, 1932) 11
3. H. R. Report No. 2192, 72nd Cong., 2d Sess., *Report on Pipe Lines*, pp. v–xxi and pp. lviii–lix 11–47
4. Table showing production of crude petroleum by States and principal fields. (Bureau of Mines, Monthly Petroleum Statement, January, 1934, p. 4) 48
5. Table showing number of wells and average daily production per well by States. (Bureau of Mines, Minerals Yearbook, 1932–1933, Statistical Appendix, p. 335) ... 49
6. Petroleum Development and Technology, 1931, American Institute of Mining and Metallurgical Engineers (Swensrud, *Economics of Distribution in the Oil Industry*) pp. 604, 609, 613, 615 49–55
7. National Petroleum News, June 1, 1932.—Holliday, *Narrower Margins Essential*, pp. 25–28 56–59

II. Cost of Production and Average Prices Received:

1. United States Tariff Commission Report to the House of Representatives on *Crude Petroleum and its Liquid Refined Products*, Report No. 30, Second Series, pp. 158–163 59–65
2. Department of the Interior, Petroleum Administrative Board, *Preliminary Report on a Survey of Crude Petroleum, Cost of Production for the Years 1931–1933*, pp. 5, 10–33 66–91

III. Physical Laws Causing Migration and Drainage in an Oil Field:

1. Federal Oil Conservation Board, Report III (1929), p. 21 .. 92–95
2. Ely, *Oil Conservation through Interstate Agreement* (Federal Oil Conservation Board), p. 3, et seq 95–99

IV. Overproduction in East Texas:

1. Federal Oil Conservation Board, Report V (1932), p. 42 .. 99–105
2. Oil and Gas Journal, July 27, 1933.—McIntyre, *Flush Fields and Illegal Oil Runs Responsible for Increased Crude Production*, p. 35 105–109

98810—34——1

V. The Effect of Overproduction in East Texas upon Prices: Page
1. Table showing daily crude production and posted prices throughout the United States, 1931–1933. (Prepared by the United States Bureau of Mines)..... facing 110
a. Department of Commerce, Bureau of Mines, Mineral Resources of the United States, 1931, Part II (Crude Petroleum and Petroleum Products) pp. 565, 566, 608–610..... 110–115
b. Department of Commerce, Bureau of Mines, Minerals Yearbook, 1932–1933, Statistical Appendix (Crude Petroleum and Petroleum Products) pp. 308, 309, 334..... 116–120
c. Department of the Interior, Bureau of Mines, Annual Petroleum Statement,1933, No. P. 123, pp. 4–5..... 121–123
2. Oil Weekly, May 15, 1933.—*Price Cuts Extend to Mid-Continent-Eastern Areas*, p. 33..... 124–129
3. National Petroleum News, May 10, 1933.—*Crude Prices Drop Under Pressure of East Texas Situation*, p. 15..... 129–132
4. Oil and Gas Journal, January 25, 1934.—Smiley, *All Records Smashed in 1933, when Motorist Paid Only 12.76 Cents for his Motor Fuel*, p. 42..... 132–135
5. Oil and Gas Journal, January 25, 1934.—*Ziegenhain, Although 1933 Ended with Higher Refined Prices, Year Worst in Industry's History*, p. 40..... 135–138
VI. The Effect of Overproduction in East Texas upon Oil Fields Throughout the Country:
1. Statements during Hearings on the National Industrial Recovery Act before the Senate Committee on Finance, 73rd Cong., 1st Sess. (S. 1712, H. R. 5755)..... 139–148
Russell B. Brown, Independent Petroleum Association of America (p. 174)..... 139–141
Joseph S. Bridwell, President of the North Texas Oil and Gas Association (p. 177)..... 141–142
W. W. Warner, President of the Oklahoma Stripper Wells Association (pp. 178, 180)..... 142–144
I. C. Grimm, representing the Governor of Ohio (p. 247)..... 144–146
Arthur Seeligson, San Antonio, Texas (p. 250)..... 146
Ralph J. Zook, representing the Governor of Pennsylvania and the Pennsylvania Grade Crude Oil Association (p. 272)..... 146–148

VI. The Effect of Overproduction in East Texas, etc.—Con. Page
2. Statements during Hearings on Conservation of Petroleum before House Committee on Ways and Means, 73rd Cong., 1st Sess. (H. R. 5720, S. 1736)..... 148–161
T. S. Hogan, representing Governor Cooney of Montana (p. 78)..... 149–152
Russell B. Brown, Independent Petroleum Association of America (p. 97)..... 152–155
J. D. Sandefer, Jr., President of the West Central Texas Oil and Gas Association (p. 103)..... 155–156
W. Scott Haywood, representing Louisiana (p. 108)..156–157
Sherman Hunt, Tyler, Texas (p. 111)..... 157–158
V. S. Welch, Artesia, New Mexico (p. 117)..... 158–159
William Bell, President of the Illinois Indiana Petroleum Association (p. 118)..... 159
Marvin Lee, Wichita, Kansas (p. 119)..... 160–161
VII. Communications urging control of production by the Federal Government:
1. Proposal from the Oil States Advisory Committee to the Federal Oil Conservation Board..... 161–164
2. Telegrams and Letters from Governors of oil-producing States urging Federal control. (Hearings on the National Industrial Recovery Act before the Senate Committee on Finance, 73rd Cong., 1st Sess., S. 1712, H. R. 5755)..... 165–175
Governor of Kansas (p. 43)..... 165–166
Governor of Pennsylvania (p. 46)..... 166–167
Governor of Texas (p. 48)..... 167–168
Governor of Kentucky (p. 48)..... 168
Governor of California (p. 48)..... 168–170
Governors of Oklahoma and Kansas (p. 50)..... 170–172
Governor of Texas (p. 50)..... 172–175
VIII. Railroad Commission of Texas Production and Storage Report for the East Texas Field, September, 1934.. 176–181
IX. Code Provisions Authorizing Limitation of Production. 182–184
X. Method of Determining Consumer Demand and Allocating it among States:
Affidavit of E. B. Swanson, Director of Petroleum Economics Division, U. S. Bureau of Mines.... 184–201

APPENDIX B

In this appendix (except under headings IX and X) are reprinted for the information of the Court excerpts from official and trade publications, referred to in the text, containing matters of common knowledge to persons familiar with the petroleum industry.

I. GENERAL DESCRIPTION OF THE INDUSTRY

1. Senate Document No. 61, 70th Cong., 1st Sess., Federal Trade Commission Report, *Petroleum Industry, Prices, Profits, and Competition:*

[Pages 6–9]

SECTION 1. *Characteristics of crude petroleum.*—Crude petroleum consists of various hydrocarbons, including small proportions of oxygen, certain nitrogenous substances, and sometimes sulphur. In general there are three important types of crude petroleum; namely, (1) Paraffin-base crudes, which contain solid paraffin hydrocarbons and practically no asphalt; (2) asphalt-base crudes, containing asphalt and no paraffin; and (3) paraffin-asphalt crudes, which are a combination of the former two types. The crudes produced in different sections of this country vary widely in viscosity and in specific gravity. Some light crudes flow almost as freely as water, while other crudes are so heavy that it is necessary to heat them in order to transport them by pipe line. The wide differences in the quality of different crudes present difficult problems in

connection with their production, transportation, and refining, and result in wide differences in price. For example, the light paraffin-base crudes produced in the Appalachian fields have always commanded a much higher price than other crudes, partly because of their high lubricating and gasoline content. In the midcontinent, the Rocky Mountain, and the California fields there is a very wide range in the prices paid at the oil wells for different crudes.

SECTION 2. *Branches of the petroleum industry.*—The domestic petroleum industry includes producing, pipe line, crude purchasing, refining, wholesale marketing, and retail marketing branches. A very large proportion of the business of each branch of the industry is handled either by large integrated companies whose activities compass the entire industry; or by concerns that have subsidiary or affiliated companies engaged in all branches of the business. A number of the larger companies own their own tank cars and operate fleets of tank steamers for coastwise and foreign trade.

Production.—The producing branch of the petroleum industry includes all of the activities incident to the exploration and location of oil lands, the drilling of oil wells, the extraction of crude petroleum from the earth and its storage in field or settling tanks. As natural gas is usually given off as the crude petroleum is brought to the surface, many producers extract casinghead gasoline from the gas and then sell the dry gas to gas companies, or, as has been done in California and in the Seminole (Oklahoma) pool, they maintain the gas pressure

in the oil pool by forcing the dry gas back into the oil well.

The great bulk of the oil lands held by producing companies is leased from the landowner on a royalty basis. One-eighth is the most common royalty portion. The producing company, if also a purchaser, usually runs the royalty portion with its own oil paying the royalty owner the current market price. If the producer sells his own crude, it is customary for the purchaser to buy the entire production, paying both the producer and royalty owner direct for his share.

Pipe lines.—The pipe-line branch of the industry collects the crude petroleum from the producer's field or settling tanks through a system of pipes called gathering lines. Gathering-line pipes are usually 4 inches or under in diameter. Much of the gathering-line pipe is laid on top of the ground. These small pipes connect with larger pipes and lead to gathering-line pumping stations. In highly productive oil pools, particularly when different producers own or control small tracts of land, there is an extensive network of gathering lines leading from the oil pool. In many cases several pipe-line companies have gathering lines in the same oil pool and sometimes on the same lease.

The topography of the region in which an oil pool is located is the most important factor in determining the type of gathering-line system that must be established. In some cases the topography of the country is such that a pipe-line company can locate its gathering-line pumping station so that the crude petroleum will flow by gravity from the producers' tanks to the receiving tanks at the pumping station.

In other cases, however, much of the crude petroleum must be forced through the gathering lines by the extensive use of field pumps located on the producer's lease, or be sucked into the gathering-line stations by suction pumps located at the gathering-line pumping station. If the producer pumps his oil into the pipe-line company's lines, he is paid for this service.

Practically all of the crude petroleum produced in the United States is collected by gathering lines, and the great bulk of it is transferred to a trunk pipe line for transportation to near-by refineries, to inland or seaboard refineries, or for transportation to a seaport, from whence it is carried to a refinery in a large tank steamer. Since 1923 large quantities of California crude petroleum have been piped to Los Angeles Harbor and from thence transported to the Atlantic seaboard by tank steamer. In times of temporary overproduction the crude petroleum may be transported to a large "tank farm", where it is stored for use when consumption exceeds current supply. The crude oil in storage, which for some time has been sufficient to supply refinery requirements for half a year or more, is largely owned by large crude petroleum purchasing companies or by petroleum refiners.

Trunk-line pipes have a much greater diameter than gathering-line pipes. The trunk-line pipes of the large interstate pipe-line companies range from 8 to 12 inches in diameter, and in some cases from 4 to 8 lines have been laid parallel to each other in order to handle the tremendous volume of crude oil which is constantly being pumped hundreds of miles to large refining centers.

Comparatively small quantities of crude petroleum are transferred from gathering lines to tank cars for shipment to near-by refineries. Occasionally where a large refiner desires to secure a certain crude unmixed with other crudes, tank-car shipments are made for considerable distances.

Crude purchasing.—The great bulk of the crude petroleum, not refined by the company producing it, is purchased by comparatively few large purchasing companies. Many of these companies are large refiners or are subsidiary to or affiliated with large refining companies. The remaining production is purchased by small refiners and by companies engaged mainly in producing and dealing in crude petroleum. The bulk of the 2,500,000 barrels of crude petroleum now being produced daily is either refined by the producing interest or sold daily at the current market price. In some cases, however, certain large companies have the production of a few large producers under contract for delivery over a considerable period of time.

Refineries.—There are three types of refineries operated in the United States. Some small refineries, called skimming plants, distill crude petroleum at atmospheric pressure and produce only gasoline, kerosene, and fuel oil. Another type of refinery, which may be termed a complete refinery, carries the refining process much farther and obtains a wide range of refined products. A number of the smaller refining companies in the East produce a complete line of refined products. The third type is one equipped with a "cracking plant", which subjects the gas and fuel oil to very high temperatures under superatmospheric pressure,

whereby the molecules are broken up or "cracked" and the lighter products are given off. Certain refining companies have produced from 50 to 60 percent of gasoline from ordinary grades of crude petroleum. Cracking plants are generally used by complete refineries and also by a large number of skimming plants.

The bulk of the refining business of the country is done by large integrated companies and by concerns having subsidiary and affiliated companies engaged in the different branches of the business.

Wholesale marketing.—The bulk of the wholesale business in gasoline, kerosene, gas oil, fuel oil, and lubricating oils and greases is done by large integrated companies. Some of these companies extend their marketing activities throughout a large number of States, others market in a single State or in a few States. These large wholesale marketers generally divide their marketing territory into two or more parts under the control of a divisional sales manager. The smaller wholesalers often confine their marketing activities to a small section of a State, usually in the more populous parts.

At the present time probably from 75 to 85 percent of the total quantity of gasoline consumed in the United States is sold to the retailer or ultimate consumer either by the company manufacturing it or by an affiliated or subsidiary concern. The remainder is purchased by wholesalers f. o. b. refinery from the smaller refiners, or from larger marketers and brokers at important seaports such as Jacksonville, Fla., Norfolk, Va., Baltimore, Md., or New York City. Gasoline is distributed in wholesale quantities in tank steamers, tank cars, barges, motor trucks, and horse-drawn tank wag-

ons. The large refiners distribute gasoline from their refineries to the principal marketing centers in tank steamers and tank cars. Tank steamers are used extensively for coastwise shipments from Gulf coast refineries to the Atlantic seaboard, from refineries on San Francisco Bay and in southern California to the large markets of the Columbia River and Puget Sound regions; and for tank-ship shipments via the Panama Canal to the Atlantic seaboard. During the last three years millions of barrels of gasoline produced in California were transported by tank steamer via the Panama Canal to the Atlantic seaboard. Daily entire trainloads of gasoline in tank cars, destined for large consuming centers, leave the important refining regions of the Rocky Mountain and Mid-Continent oil fields and the large refineries in the East.

Extensive storage facilities are maintained in the large cities along the Atlantic, Gulf, and Pacific coasts and at important interior refining points from which the requirements of the retail dealer are supplied. Shipment is made from such points in tank cars and barges to bulk stations, from which point retail dealers are supplied by tank truck or tank wagons. The seasonal demand for gasoline necessitates the accumulation of large stocks during the winter months in order to meet the requirements of the heavier spring, summer, and autumn trade. The bulk of the retailers' supply of gasoline is distributed by tank trucks or tank wagons from storage tanks located near railroad sidings. Tank-truck and tank-wagon drivers usually sell at retail to anyone on the route who will buy 5 gallons or more at a single purchase.

Kerosene is distributed in the same way as gasoline but the quantities sold are much smaller. Sales of gas and fuel oil and road oils are largely made direct from the main sales offices of refining companies. These products move in large quantites. Lubricating oils and greases are sold in containers, such as barrels, cans, and cases. Transportation and manufacturing companies buy these products in large quantities. The motor-vehicle consumption is supplied through the gasoline and kerosene wholesale and retail marketing organization.

Retail marketing.—Gasoline is distributed to large consumers in barges, tank cars, tank trucks, and tank wagons, and to small consumers through service or filling stations, garages, repair shops, curb pumps, etc., and to a limited extent from tank wagons and tank trucks. Many large wholesale marketing companies operate a large number of service stations, and many small wholesalers are also engaged in the retail business. C. B. White, Chicago Manager of the Vacuum Oil Co., stated recently that whereas five years ago there were 12,000 gasoline service stations in the United States there are now "more than 250,000 outlets for oil and gasoline—only 80 cars per station."[1] This later total includes service stations, garages, curb pumps, etc. In the Standard Oil Co. (Indiana) territory, which covers 11 States, there were 19,393 service stations in 1926, as compared with 4,875 in 1921.

[Pages 99–100]

SECTION 1. Methods of marketing crude petroleum—*Running crude into gathering lines.*—As al-

[1] National Petroleum News, Apr. 20, 1927, p. 27.

ready pointed out, crude petroleum in all the oil fields of this country is collected or gathered from the thousands of oil wells by a system of pipe lines called gathering lines. When crude petroleum is brought from the oil pool to the surface of the earth through the tubing of an oil well, either by pumping or by gas pressure, there is mixed with it varying percentages of water, sand, and other sediment. In order to separate the water and sediment from the crude, it is run into tanks called settling tanks, where the water and other sediment is allowed to settle to the bottom of the tank before the crude is run into the gathering lines.

The crude run into the gathering lines also carries more or less sediment. Usually the purchasing company makes a deduction of 3 percent from the total quantity to cover any water or sediment remaining in the crude run from the producer's tanks. Particularly for purchases of large quantities and where the crude is known to contain a large proportion of water and sediment, additional deductions are based on centrifugal tests. As crude petroleum expands upon being heated, adjustments are made to cover changes in quantity due to difference in temperature.

When a producer first sells crude petroleum, or when new wells are brought in, the pipe-line company gathering the crude connects the producer's tanks with its gathering lines. The cost to a pipeline company of making a "connection" with a new producer or with a new lease varies widely from a few hundred dollars to $2,000, or even more. In some cases in a given oil pool a producer may have his tanks connected with two or more pipe-line sys-

tems, but in practice many small producers are limited to but one purchaser because only one pipe-line system is available. As a rule a producer is free to have his property disconnected from one pipe-line system and connected with another, and this may occur if the quantity he has to sell is sufficiently large to make it attractive for a rival pipe-line company to make a connection. In some cases, where the expense of making a connection is very large, the pipe-line company making it insists upon a contract guaranteeing to it the output of the well or lease for a specified time.

When a producer has a tank full of crude petroleum ready to deliver to the pipe-line company, he notifies the company's gauger, who, after gauging the contents of the tank, opens a valve that permits the crude to flow or to be pumped from the tank into the gathering lines. Later, after the tank has been emptied to a certain point, the valve is closed, thereby "cutting out" the tank from the gathering line; then the tank is gauged again and a ticket is issued showing the height of the crude in the tank at each measurement. This ticket also serves as a receipt for the producer. The quantity of crude petroleum taken is determined by the purchasing company by reference to tank tables, carefully computed from actual measurements, which show the cubic contents for every tank from which crude is purchased for every difference in height in graduations of a quarter of an inch. The quantities of crude petroleum gathered from an oil pool or an oil field are termed "pipe-line runs."

2. Department of Commerce, Bureau of Mines, *Mineral Market Reports* (No. M. M. S. 154, Nov. 16, 1932):

National distribution of gas oil and fuel oil, 1930–1931

[Figures in barrels of 42 gallons each]

Uses	1930 [1]	1931
Railroads	67,900,035	58,150,366
Steamships (including tankers)	94,151,823	83,558,580
Gas and electric-power plants	26,768,557	24,490,251
Smelters and mines	5,936,055	3,626,549
Iron and steel products	15,210,420	12,855,395
Chemicals and allied industries	3,258,156	2,907,773
Automotive industries	2,225,272	1,783,547
Textiles and their products	4,474,846	5,683,693
Paper and wood pulp	2,235,890	1,833,880
Logging and lumbering	2,269,346	1,667,377
Cement and lime plants	3,007,547	2,434,567
Ceramic industries	1,992,531	1,598,485
Food industries	7,033,361	5,660,080
Other manufacturing	11,663,906	9,998,329
Commercial heating	17,508,085	15,731,150
Domestic heating	10,104,792	10,446,139
United States Navy, Army transports, etc	8,680,929	9,203,243
Used as fuel by oil companies	53,436,945	51,196,684
Miscellaneous uses	11,235,312	10,266,692
Domestic deliveries	349,093,808	313,092,780
Exports and other shipments	36,449,884	29,231,049
Deliveries of furnace oils, etc., for domestic heating	15,666,000	14,213,000
Total distribution	401,209,692	356,536,829

[1] Revised figures.

3. H. R. Report No. 2192, 72nd Cong., 2d Sess., *Report on Pipe Lines:*

[Pages v–xxi]

THE OIL SITUATION

Petroleum, oil, and gas, like the metallic ores and other minerals, are a natural resource which, once exhausted, cannot be replaced. A sound national policy calls for careful conservation of all natural resources, but in the case of no other of like importance to our national life is the need so pressing.

Doubtless a time limit exists for the duration of our coal, iron, copper, and other mineral reserves,

but the date is far in the future. It appears to be otherwise with petroleum. In the report of the Federal Oil Conservation Board to the President of the United States, published in 1926, it was stated that the total reserves in the known and proven wells were estimated at 4,500,000,000 barrels, or about six years' supply.[2] This figure has only admonitary significance.

The six years have passed. The public demand for petroleum has been supplied; indeed, in a sense, more than supplied, for the general complaint on all hands is of overproduction, and it would be rash to set any definite time limit to our supply even now. Since the report appeared petroleum production increased from 764,000,000 barrels in 1925 to 1,006,000,000 barrels in 1929. Since then production has fallen off to 898,000,000 barrels in 1930 and 845,000,000 barrels in 1931–32. This falling off, however, is not due to depletion or immediate prospect of depletion. It is estimated by experts that the potential production at the present time is

[2] Report of the Federal Oil Conservation Board, Part 1, 1926, p. 6. It was obtained by dividing an estimate of the quantity of oil in proven sands accessible to wells already drilled and recoverable by methods then in use by the consumption for that year. On the one hand it was too generous. Recovery from the known and proven wells could not maintain the then existing rate of consumption without decline, because the yield of a well decreases steadily year by year. On the other hand, the figure of six years was not intended to fix the life of the oil industry. It made no attempt to allow for the finding of new fields or for improved methods of recovery from known and proven fields. However, the board's figure served to illustrate vividly the national dependence upon fortuitous discovery of new sources of supply and to call public attention to the urgency of conservation.

5,000,000 barrels a day if all wells were run to full capacity and that this rate could be maintained for a considerable number of months. The actual output is about 45 percent of the potential.[3] The falling off, then, is not due to depletion, it is rather due to the coercive measures of curtailment taken by the several conservation commissions of State authorities. With a return to prosperity the upward trend in production will doubtless be resumed. How rapid has been this upward trend in the past may be seen from the following table.

Production of crude petroleum in the United States

	Barrels		Barrels
1900	63, 600, 000	1917	335, 300, 000
1901	69, 400, 000	1918	355, 900, 000
1902	88, 800, 000	1919	378, 400, 000
1903	100, 500, 000	1920	442, 900, 000
1904	117, 100, 000	1921	472, 200, 000
1905	134, 700, 000	1922	557, 500, 000
1906	126, 500, 000	1923	732, 400, 000
1907	166, 100, 000	1924	713, 900, 000
1908	178, 500, 000	1925	763, 700, 000
1909	183, 200, 000	1926	775, 000, 000
1910	209, 600, 000	1927	903, 800, 000
1911	220, 400, 000	1928	901, 500, 000
1912	222, 900, 000	1929	1, 007, 300, 000
1913	248, 400, 000	1930	898, 000, 000
1914	265, 800, 000	1931	845, 800, 000
1915	281, 100, 000	1932	
1916	300, 800, 000		

In its fourth report, issued in 1930, the Federal Oil Conservation Board commented further on the extent of the underground reserves. Its figures of 4,500,000,000 barrels in 1926 had not attempted to measure the total potential reserves of the country, but was intended to indicate the relatively small extent of known and proven reserves accessible to

[3] Anderson, W. F., The Oil and Gas Journal, Jan. 18, 1932.

existing wells. Nevertheless, the progress of technology was operating to increase the reserve potentially available. "During the last decade", stated the board,[4] "every estimate that had been made of the recoverable oil remaining in underground storage has required revision in the light of later increased production factors." The reasons given for the changing viewpoint on reserves throw considerable light on the difficulties and uncertainty that must be reckoned with in estimating the duration of our petroleum resources. They are useful in tempering our judgment between alarm and complacency. A brief summary will be given in the following paragraphs.

It was pointed out:

(1) That great advances have been made in oil geology. Improved technique in determining the location, shape, and extent of structures favorable to the accumulation of oil have been developed, and as a result new and prolific oil sands have been tapped.

(2) That deep drilling has resulted in the recovery of oil at depths hitherto thought unattainable. In 1925 a depth of 5,000 feet had been thought an outstanding accomplishment. By 1930 practically all the problems for attaining a depth of 10,000 feet had been solved. Special steels and cements for enduring the high temperatures of the deep borings have been developed and improved engineering methods to meet the new conditions have been forthcoming.

(3) That improved methods have made it possible to recover a much larger proportion of the oil con-

[4] Federal Oil Conservation Board, Report IV, p. 6.

tained in known and proven sands. Large quantities of oil have been recovered from fields which had been abandoned or apparently exhausted. A "second crop" from the Bradford and Allegheny fields has added 600,000,000 barrels to the recoverable supply.

These discoveries in science and these improvements in technique had, therefore, greatly extended the limits which seemed closing in on the possibilities of oil recovery when President Coolidge appointed the board in 1924. Yet, as the report was careful to point out, lest the inadequacy of earlier estimates should lead to a too easy optimism for the future, none of these discoveries or improvements had added a barrel to the physical quantity of oil in the reserves. They merely meant that through them such reserves as there were had been depleted to a greater extent than had been deemed possible. They in no wise made it a matter of less national concern to conserve these resources and to avoid waste.

One thing is brought out forcibly by both reports. It is this: That maintenance of output sufficient to meet an existing, and probably increasing, demand involves in addition to whatever improvements may be made in engineering methods, constant recourse to new drilling and to new fields. The flow from a given well, however copious it may be at first gradually declines, and in spite of all improvement in technique must ultimately cease, simply because no more oil can be recovered. New borings must be made and new areas sought. For a quarter of a century, in order to meet the demand for oil, there have been completed an average of 15,000 new wells annually, and there is no reason for thinking that

this will be less in the future under the existing law and present methods of production.[5]

This leads to the question, What is the prospect of discovery of new fields? At best it is uncertain. While in recent years great advance has been made in petroleum geology, the location of oil deposits from surface indications is still conjectural. Even more conjectural is the richness of the deposit when one is located. On this point these words from Thom may be quoted. "It is never possible for a geologist to say (honestly) that geologic evidence proves that oil is present beneath a particular locality in commercial quantities. Only actual drilling can prove the productivity or nonproductivity of a promising anticline or other structural feature. On the other hand * * * it is possible for a geologist to say that certain regions and areas are barren of valuable oil deposits because of the nature of the rocks occurring at the surface of those regions.[6] That is, a geologist can say of one region from surface indications, "No oil is here, it is useless to drill", of another from application of geo-

[5] McIntyre, James, Field Operation Suffered in 1931. The Oil and Gas Journal, Jan. 28, 1932, p. 15. The actual record, including oil wells, gas wells, and dry holes for the last 10 years was as follows: 1922, 24,658; 1923, 23,438; 1924, 21,894; 1925, 25,623; 1926, 29,319; 1927, 24,143; 1928, 22,331; 1929, 26,356; 1930, 21,240; 1931–32, 12,245. Of all the wells drilled an average of 62.3 percent were oil wells; 10.4 percent gas wells; and 27.3 percent dry holes. The falling off in 1930 and 1931 is doubtless due mainly to the depression, though the enormous yield of the east Texas field in 1931 (of which more will be said later) was probably a contributory factor.

[6] Thom, W. T., Jr., Petroleum and Coal: the Keys to the Future, 1929, p. 122.

physics, "Oil may be here, but you can't be sure till you try."

On this basis geologists tell us that 43 percent of the area of the United States is barren of oil, and that of the remaining 57 percent only a comparatively small portion is at all promising. However, 57 percent of the United States is a large area. About all that can be said on the basis of our present geological knowledge is that the duration of our oil reserves is very indefinite. Even with the most intelligent methods applied to their conservation their duration cannot be made to compare with that of our coal and iron reserves. The end may be postponed for a century or so. It is possible that it may come within a relatively short period.

Nor can we look forward with complacency to supplies from other regions of the world when our own reserves are exhausted. The United States now produces and consumes not far from two-thirds of the world output. Its reserves are among the richest in the world. When they prove insufficient to the need and the United States seeks other fields, its enormous rate of consumption, combined with the consumption of all other countries leaves little room for optimism for long duration of the world's reserves. Even assuming that other countries would grant free access to their reserves—a rather questionable assumption—the end would seem to be in sight. In 1920, Dr. David White published an estimate that the portion of the world's oil reserves recoverable by methods then in use amounted to 60,000,000,000 of barrels.[7]

[7] Ibid, p. 203.

This estimate, which it is to be observed, includes the reserves of the United States, may fairly be multiplied by two or three to make allowance for improved methods which have come into being since the estimate was made, but even then with a present world annual consumption of about 1,500,000,000 barrels, to say nothing of a probable increase, a little over a century would seem to be the limit of our period of grace.

The prospect of the complete exhaustion of the world's oil reserves naturally raises the question of substitutes. What is to take the place of petroleum when the lean years set in? A disposition is manifested in some quarters to rely blindly on the progress of science and invention. There is here an unbounded field for speculation, and in view of the amazing achievements of science in the recent past, it would be foolish to assert that such blind faith is wholly vain. Such faith is fortified rather than weakened by the reflection that the end will not come suddenly. As the reserves approach exhaustion the price of all petroleum products will rise, and the rise in price will be the very thing needed to stimulate research and inventive genius. Petroleum is a form of stored energy, probably derived like practically all our other forms of energy, indirectly from the sun. The sun is still flooding the earth with light and heat, a theoretical horsepower to every three-eighths of a square yard receiving the vertical impact of its rays. It has been estimated that the energy received by the earth directly from the sun amounts to about 160,000

horsepower per capita of the earth's present population.[8]

Human ingenuity may yet harness some fraction of this inexhaustible store. Oil may be obtained from coal and from oil shale. Industrial alcohol may be used as a motor fuel. All things are possible in the unconfined spaces of the imagination. All that can now be said with assurance is that for petroleum in some of its uses no practical substitute is in sight except at price levels far above what we are accustomed to pay.

It might be supposed that rational beings intrusted with a definitely limited supply of a substance of such vital importance to their civilization would have displayed great economy in its production and use. In fact, as a result partly of indifference but partly of the legal rule of capture applicable to the development of oil and gas properties, the waste has been appalling. To understand the nature and sources of this waste a few

[8] Ibid, p. 214. The same author quotes from the Transactions of the First World Power Conference (Vol. IV, p. 1308) the following estimates made by Prof. Svante Arrhenius, of the comparative energy values of certain major sources of energy:

Total energy of world's oil reserves	1.00
Total energy of world's coal deposits	367.00
Energy of coal consumed annually	.08
Energy of air currents (annual figure)	275.00
Energy annually stored by growing plants	1.25
Energy of utilizable water power (annual figure)	.33
Solar radiation of heat to earth's surface (annual figure)	442.00

Thom thinks that in the light of recent improvements in geological and engineering methods the estimate for oil should be increased seven fold.

words must be said in regard to the geology of petroleum occurrence and the technique of its exploitation.

Petroleum, associated with natural gas, is found in what are called "oil sands" at varying distances below the earth's surface. It is a mixture of a considerable number of hydrocarbons of varying degrees of volatility, and is believed to have been elaborated under heat and pressure from substances of animal or vegetable origin in the process of decomposition. It first appeared as minute and scattered droplets, often in oil shales. Concentration in paying quantities required a combination of geologic factors: A porous reservoir rock, usually an "oil sand"; a local "fold" or "dome"; and an impervious cover, arresting escape of the oil to the surface. Such are the conditions essential to an oil pool, being source rock, porous formation for migration and accumulations and undulations, or a departure from horizontal in the earth's strata.

Recovery is effected by boring or drilling until the pool is tapped. A "derrick", familiar in picture of oil fields, is erected over the point of operation. As the drilling proceeds strings of pipe, known as "casing", are lowered for the purpose of lining the hole. When the oil sands are reached the natural gas with which the petroleum is usually associated is suddenly released from the high tension under which it has remained pent up for untold ages. It forces its way through the sands, carrying the petroleum with it, and rushes, often with great violence, upward to the surface.

The "flush flow", when the pool is first tapped, is often very vigorous and copious, sometimes

spouting to a great height in the air. In this case the well is called a "gusher." After a time the pressure subsides and the flow becomes more gentle, or it may even require a pump to bring the oil to the surface. As time goes on the yield becomes less and less copious. Finally, the flow ceases and the well is abandoned. Abandonment, however, does not mean that all the petroleum in the pool has been recovered. Far from it. It is the general opinion that much more remains than is recovered. Estimates of the proportion left in the ground range from 25 to 90 percent, the commonest estimate being 80 percent.[9]

Such disparity in the estimates is to be expected, from the nature of the case, and undoubtedly the proportion recovered does in fact vary greatly with different geologic conditions and methods of operation. But from the standpoint of the present discussion, the fact that leading experts hold that only about a fifth of the oil is recovered from the sands by the methods of recovery in general use is of tremendous significance.

From this brief outline of the principles of petroleum geology and of the methods in use for recovering the oil it is possible to understand why more than in the exploitation of any other natural resource, the recovery of petroleum has been accompanied by enormous waste. These wastes will be discussed under the following heads: (1) Wastes connected with the flush flow. (2) Wastes from incomplete recovery. (3) Wastes from unrestricted competition.

---

[9] Osgood, Wentworth, H., Increasing the Recovery of Petroleum, p. 5.

(1) Wastes connected with the flush flow: As just explained, when the pool is first tapped the natural gas which has been held back for ages rushes to the surface, carrying the oil with it. When the flow is very great, vast quantities of both oil and gas may escape into the air unless the well is promptly brought under control. In the past "gushers" have sometimes run wild for weeks before being brought under control, with an absolute waste of millions of barrels of oil. Sometimes the oil caught on fire, with great danger to life and property and with great money loss involved in extinguishing the fire or "killing" the well.

With the great advances in oil-field technology of the last few years, losses of oil through wells escaping from control and running wild are now seldom serious. Losses of natural gas from this cause, however, are still a grave problem under certain geologic conditions, as indicated by the wild "crater wells" in the Richland gas field of Louisiana.

Great as is the loss when wells are allowed to run wild, this is by no means the full extent of the waste. As we have seen, it is the pressure of the natural gas that brings the oil out of the sands into the well. Hence the oil when it reaches the surface is always accompanied by gas. But when the well is drilled primarily for oil, it often happens that no arrangements have been made for utilizing the gas. The oil is conserved but the gas is permitted to escape into the air. Yet the energy value of the gas thus lost may exceed that of the oil retained. In the Cushing field in Oklahoma the estimated waste from this source was 300,000,000 cubic feet per day

or 100,000,000,000 cubic feet per year, a loss of energy equal to that embodied in 5,500,000 tons of coal.[10]

The fourth report of the Federal Oil Conservation Board cited two wells in Federal leases in California which had turned into pipe lines nearly $5,000,000 worth of oil, but which had meanwhile permitted gas to a value of $10,000,000 to escape into the air.[11] The same report also stated that in the Kettleman Hills area the gas which was allowed to escape, even without counting its gasoline content, was worth more at existing field prices than the high-grade oil which that gas brought to the surface.[12]

Other examples of the waste of natural gas are cited in the fifth report of the Federal Oil Conservation Board:

> In the Oklahoma City field alone, the wastage probably has averaged 300,000,000 cubic feet of natural gas per day for the past two years.[13]
>
> From January 1, 1920, to March 31, 1932, there has been produced in California a total of 3,527,309,000,000 cubic feet of natural gas. Of this amount 2,294,000,000,000 cubic feet, or 65 percent, has been utilized and the remaining, 1,233,309,000,000, or 35 percent, has been wasted.[14]

Another cause of loss associated with the flush flow is the practice of flowing oil into earthen pits

[10] Report of Federal Oil Conservation Board, pt. 1, p. 7.
[11] Ibid., Part IV, p. 25
[12] Ibid., Part IV, p. 16.
[13] Report V of the Federal Oil Conservation Board, p. 50.
[14] Ibid., p. 47.

in the absence of steel storage. As pointed out in a memorandum the committee has received from the United States Bureau of Mines—

> this practice has occurred many times in the development of new fields and always has caused physical waste of crude oil through evaporation and seepage into the ground. Operators are well aware of the wastefulness of earthen storage, but nevertheless it is often resorted to in the stress of overproduction.

(2) Wastes from incomplete recovery: Among the most serious of all causes of waste is the premature or irregular encroachment of salt water in the producing sands, brought about by hasty and unregulated competitive drilling. The salt water normally underlies the oil or encircles the margin of the pool, advancing upwards as the oil is removed. If drilling proceeds irregularly, large bodies of oil may be trapped by advancing bodies of water or the two may become so mingled that the oil is rendered valueless. The amount of oil so lost cannot be measured, but it is certainly very great.

A further and enormous loss of oil arises from the premature dissipation of the gas pressure. The comparatively small percentage of the total oil content of the sands which is actually recovered has already been referred to. The gas is frequently the chief propulsive agent which forces the oil out of the sands, and if this gas is allowed to escape, as it does when a well is permitted to run wild, even the small percentage of the total which can be recovered without resorting to artificial pressure is greatly reduced. Therefore, if gas is not conserved in the flush flow, there is loss not only from the gas

that escapes but from the oil which might have been, but is not, recovered.

This latter loss, however, is not necessarily complete. Artificial pressure from air, gas, or water may be introduced into the sands and a second crop of oil extracted therefrom. However, this involves great expense, and heavy consumption of fuel to provide the necessary energy, and it is clearly good economy to recover as much oil as possible by means of the propulsive agent which nature has provided.

An illustration of increased recovery from oil fields by new methods is afforded by the Bradford field in McKean County, Pa. In 1922 the average daily production in the county was 5,195 barrels. Water flooding has greatly increased the recovery as is shown by the fact that in 1931 the daily average production in McKean County was 24,396 barrels.[15]

Just how great are the possibilities from the second crop of oil from abandoned wells is something of a matter of conjecture. Experience warrants the belief that a second crop equal to the first may be recovered, particularly in certain fields. Some oil men are so optimistic as to predict a recovery of from two to three times the first crop. A recent writer in a 2-volume work devoted exclusively to this subject makes this striking statement.

> The amount of oil left underground in fields that have been abandoned offers more attractive opportunities for increased production than wildcat territory.[16]

---

[15] Proceedings of the Pennsylvania Mineral and Forest Land Taxation Commission, December 1932.

[16] Osgood, Wentworth H., Increasing the Recovery of Petroleum, p. 77.

All such secondary recoveries, however, imply increasing cost of production and higher prices to the consumer.

(3) Wastes from unrestricted competition: To a great extent the wastes already discussed arise from this source. In other industries waste of natural resources is one of the black marks that must be set against competition. The eager haste and low prices which it induces compel competing owners, under penalty of being squeezed out, to "skim the cream" from their holdings and leave much valuable material which under a more rational system of industry might be utilized. But in no other field is the compulsion to waste so great.

The oil, as we have seen, is stored in a "pool" of considerable extent underground, but this "pool" may lie under the properties of many competing owners. The typical pool underlies the holdings of dozens or scores of farmers; and under conditions of town-lot drilling the number of surface owners may run into many hundreds. Consider the case at a section corner where four farms join. Obviously, if one owner drills a well near his corner, the other three owners are compelled also to drill under penalty of having the oil lying under their respective properties appropriated by the first owner. The law, generally so jealous of the rights of private property, has offered no protection to the owner of oil lying under his holding, if another owner can take it from him by drilling into the pool from an adjacent holding, and thus furtively drawing it away from him.

This situation has led to unseemly haste in the drilling and operation of wells. It has resulted in enormous wastes from "gushers" through the es-

cape into the air of oil and natural gas in the manner already described, and it has resulted in waste of another sort arising from the effect of such unrestricted competition on the market. From what has been said it is evident that competition of the character described leads to production entirely independent of market conditions. Owners who would prefer to conserve their underground supplies for a better price feel themselves forced to produce and sell today, lest they have no oil to sell tomorrow. Hence, prices are forced down to ruinous figures, entailing not only money loss on all persons having oil to sell—those outside of the particular competitive field as well as those within it—but also the waste which always accompanies the utilization of commodities sold at an unnaturally low price.

A striking illustration of the wastes arising from unrestricted competition occurred in the east Texas field in 1931. This region, a vast area of 120,000 acres, was solidly leased up mostly to small operators and newcomers in the business and among them numerous promoters of stock-selling schemes. So much of the region was held in small parcels ranging from 1 acre up, and ownership was so diversified, that it was impossible to bring about coordinated action or orderly development. Production mounted rapidly. The average for February 1931 was 26,062 barrels per day; for March, 93,579; for April, 249,325. The peak was reached in August when for two days (August 15 and 16) the daily output was over 1,000,000 barrels. At this point Governor Sterling stepped in. Martial law was declared and National Guard troops were ordered into the field to shut in the wells. Since August 17,

when the State government intervened, the output has been kept somewhat under control.

A group of operators met at Tyler on August 6, and again on August 14 and voiced an opinion in favor of a general shutdown. A committee waited on the governor and on August 17 the order for shutting the wells and calling out the National Guard was issued.

The whole matter was taken to the Supreme Court of the United States and the action of the Governor of Texas was held to be unconstitutional.[17]

All of the wastes which have been referred to as an incident to unrestricted competition developed in the east Texas field. There were many oil well fires and other serious accidents. Two of the fires cost a dozen lives. One well burned for 26 days before it was brought under control. As a result of the frantic struggle for precedence in oil recovery insecure construction and inferior equipment were inevitable. Many derricks were constructed of green lumber. In the drying process nails and bolts were pulled out and the derricks gave way under the stress of pulling casing or doing other heavy work. Improper completion of wells was the cause of a majority of the fires, and the railroad commission was compelled to issue rules and regulations in regard to completing wells, introducing safety features, and eliminating risks which operators were taking in order to save money. Millions of tons of secondhand material and equipment —some of it unusable—was moved into the district from other fields in Texas and other States, and

[17] Decided by Supreme Court. *Sterling* vs. *Constantin*, No. XI; October Term, 1932. U. S. Supreme Court, Lawyers Edition 77, page 254.

used in the place of new and safer equipment. This was a source of other accidents and fires. It was a boon to oil-field workers when operators were forced to start purchasing new equipment.[18]

The effects of unrestricted competition in the east Texas field did not end with the losses of the operators and the accidents to the workers. It meant a considerable depletion of our oil reserves, demoralization of the industry, and the wastes in utilization that accompany an unnaturally low price. The matter was clearly one of national concern. The importance of the east Texas oil field in relation to the total oil production of the United States can be inferred from the following table and diagram:

United States production of petroleum, 1924–1931, by States

[In thousands of barrels]

State	1924	1925	1926	1927	1928	1929	1930	1931	Number active wells, December 31, 1931	Daily average per well (barrels)
California	230,063	230,147	224,117	230,751	231,983	292,037	226,092	188,829	8,911	58.07
Oklahoma	176,206	173,270	177,651	276,022	247,501	252,229	216,115	175,704	58,707	8.20
Texas	135,361	144,783	172,545	220,031	255,354	298,713	292,392	328,609	22,431	40.14
Arkansas	48,168	78,407	58,730	40,411	32,138	25,444	20,115	15,626	3,231	13.25
Kansas	29,672	38,152	41,347	41,944	38,150	40,658	42,123	38,956	16,708	5.71
Wyoming	39,251	29,229	25,466	20,984	21,403	19,072	17,740	14,692	3,536	11.38
Louisiana	20,638	21,538	24,283	24,331	22,863	21,137	23,881	22,857	2,976	21.04
Illinois	8,041	7,862	7,770	6,873	6,475	6,356	5,651	4,717	15,300	.85
Pennsylvania	7,529	7,831	8,971	9,642	9,914	11,805	12,918	11,862	77,300	.42
Ohio	6,797	7,175	7,307	7,542	7,105	6,730	6,483	5,318	37,250	.40
Kentucky	7,397	6,770	6,297	6,590	7,350	7,821	7,462	6,490	15,700	1.13
West Virginia	5,924	5,780	5,962	6,033	5,746	5,609	5,111	4,477	15,200	.81
Montana	2,786	4,123	7,745	5,172	3,999	3,827	3,204	2,847	1,429	5.46
New York	1,482	1,860	1,934	2,237	2,579	3,346	3,854	3,395	14,710	.63
Colorado	392	1,172	2,776	2,723	2,744	2,362	1,624	1,493	244	16.76
New Mexico	82	1,097	1,696	1,214	974	1,803	10,377	15,360	441	95.43
Indiana	936	828	785	852	1,054	906	990	831	2,480	.92
Tennessee	6	23	44	62	50	20	20	7		
Michigan			103	436	613	4,391	3,589	7,733	550	18.59
Miscellaneous			31							
Total	720,731	759,847	775,560	903,850	897,995	1,004,266	897,741	845,803	299,104	7.75

[18] Authority for statements about east Texas field, from Oil and Gas Journal, Jan. 28, 1932, McIntyre, James, East Texas Depressed Whole Industry, p. 56; and Bredberg, L. E. Year's Record of World's Greatest Oil Field, p. 58.

The table and chart are presented not only as throwing light on the point at present under discussion but as matters of general interest, showing, as they do, the relative position of the States in petroleum production and the upward or downward trends of the industry in each of them. It will be noted that the States upon which reliance for the great bulk of our oil supply must be placed are Texas, California, and Oklahoma, and that of these three Texas has shown the most rapid rate of increase and is at present furnishing by far the greatest output. The States standing next to the three giants are Arkansas, Wyoming, Kansas, Louisiana, Illinois, and New Mexico. However, the output of these and of all the other oil-producing States, individually or even collectively, is small compared with that of Texas alone. (The 1931 production of all of the States outside of Texas, California, and Oklahoma was 152,661,000 barrels; that of Texas alone 328,609,000 barrels.)

Referring now to the table and chart it will be seen that while nearly all the States showed a decline in output for 1931 as compared with 1930, Texas showed an increase of 36,217,000 barrels—an increase greater than the total production of any other State except California, Oklahoma, and Kansas. This increase came from the east Texas field, as production in other Texas fields was normal. Production in Texas rose from 48 percent of the production of all other States in 1930 to 63 percent in 1931.[19]

[19] The only States outside of Texas showing any increase in 1931 were New Mexico (10,377,000 to 15,360,000 barrels) and Michigan (3,589,000 to 3,733,000 barrels).

From these figures the national importance of the competitive situation in east Texas can easily be seen. Even in normal times such an increase could not have failed to have had far-reaching effects. Coming, as it did, in a period of general business depression, the effect was greatly augmented. The price of crude petroleum which had been about a dollar a barrel rapidly declined until August 12 when it touched low level of 13 cents a barrel and even lower.[20]

The low price, which was a loss to owners and operators, was a benefit to consumers. From a national standpoint and from the standpoint of the economic philosophy underlying the theory of competition it may seem a matter of no concern that one class of the community should gain at the expense of another. From the standpoint of conservation, however, it is a matter of concern. The throwing of such a vast quantity of petroleum on

[20] In a recent address before the Texas Oil and Gas Conservation Association at Forth Worth, Tex., Jan. 9, 1933, C. B. Ames, president of the American Petroleum Institute, said:

"There are approximatly 350,000 oil wells in the United States producing an average of one or two barrels a day. These may be referred to as wells of settled production. It is clear that in the public interest these wells should be preserved. They will continue to produce for many years, but if they are abandoned the oil they produce may be lost on account of the difficulty and expense of restoring the wells. A sound conservation program calls for the preservation of this supply, and these wells of settled production should be allowed to produce without restraint."

The institute made an analysis of crude oil production for the month of June 1931, "to show the number of wells required to produce certain approximate portions of and the

the market and the consequent slump in price meant a wasteful present use and a more speedy depletion of oil reserves. Another large pool may be discovered in one of the States at any time. If it should be in Texas, the waste would not be as great as in 1931, because of the increased power of

---

total average production of the United States during the period covered." This tabulation follows:

Approximate daily production	Actual production	Number of producing wells	Average production per well per day
Barrels	*Barrels*		*Barrels*
500,000	500,649	1,187	422
750,000	737,109	2,212	333
1,000,000	1,011,063	3,875	261
1,100,000	1,105,028	4,637	238
1,200,000	1,223,061	5,909	207
1,300,000	1,292,605	6,758	191
1,400,000	1,404,965	8,356	168
1,500,000	1,504,448	10,000	150
1,600,000	1,601,365	11,804	136
1,700,000	1,709,407	14,593	117
1,800,000	1,804,558	17,913	101
1,900,000	1,899,209	22,875	83
2,000,000	1,996,325	30,313	66
2,100,000	2,100,902	41,546	51
2,200,000	2,199,761	56,734	39
2,300,000	2,297,786	84,891	27
2,400,000	2,353,156	137,066	17
2,500,000	2,462,756	319,385	8

Recent forecasts by two expert committees, appointed by the Federal Oil Conservation Board and by the American Petroleum Institute, indicate that during the first quarter of 1933, the total production of the United States should not exceed 2,000,000 barrels per day. A reference to the foregoing table shows that at the rate of production in June 1931, the requirements of 2,000,000 barrels per day could be met from the production of somewhat more than 30,000 wells. In the absence of control of production, through conservation measures, over any extended period it is evident that the uncontrolled flush production of about one-tenth of the wells would force the abandonment of a considerably greater number of pumping wells in the older fields. The preservation of the supply of oil from these smaller wells clearly indicates the importance of conservation control.

the Texas Railroad Commission to enforce conservation laws.

The wastes so far considered arise in connection with the production of petroleum. Wastes—or at least the possibility of a wiser conservation—arise in connection with its utilization.

Crude petroleum, as was stated, is a complex mixture of a considerable number of hydrocarbons of varying volatility. The most volatile is the natural gas which at once separates itself from the petroleum when the pressure is released by the tapping of the "pool." The liquid petroleum after recovery is run into stills where it is subjected to increasing heat. At a comparatively moderate temperature the most volatile component is expelled, and as the heat increases components of decreasing volatility are obtained. In this way the crude petroleum is made to yield several hundred distinct substances—gasoline, kerosene, lubricating oil, fuel oil, and other products—each having its appropriate use or uses.

By the process of straight distillation these components of the crude petroleum are thrown off in more or less stable proportions:[21] Hence, if the matter ended here, it would follow that a strong

[21] Crude petroleums from different regions vary considerably in their composition. Some are richer in the lighter and some in the heavier hydrocarbons. For example, the petroleums from the two principal Mexican fields are quite different, "The northern, or Panuco field, producing a heavy, viscous petroleum of 10° to 13° Baumé gravity; and the southern, or light oil field, producing a lighter petroleum of 19° to 22° Baumé gravity, more suitable for refining than the heavy crude of the northern field."—(Pogue, Joseph E., The Economics of Petroleum, 1921, p. 320.)

demand for one of the joint products would lead to the distillation of so great a quantity of crude oil as to yield a serious over-production of others. Fortunately, however, the several hydrocarbons have a family resemblance, and it has been found possible by a process known as "cracking" to break up the more complex molecules of which the heavier and less volatile components are composed and recompose them into the molecules of the lighter components. Hence, there is considerable range in proportions for practically all the components. This is shown by the following table:[22]

	Percent		Percent
Motor fuel	28. 7–60. 0	Wax	0. 2– 0. 5
Kerosene	7. 5–25. 0	Asphalt and road oil	2. 7–15. 0
Gas oils	3. 9–50. 0	Coke	0. 5
Diesel engine oils	1. 7–70. 0	Marine fuels	13. 4–80. 0
Lubricating oils	3. 7–20. 0	Land fuels	34. 5–80. 0

It is possible, therefore, so to apportion the components of the crude petroleum as to regulate the supply with reference to demand. If private business is left to its own devices, this adaptation will automatically adjust itself on a profit basis. That is, the refiner will so adjust his runs of crude oil through cracking units, at current prices, so to yield a maximum net income. If there were no acute problem of conservation, such an adjustment would be regarded as satisfactory. But since the problem of conservation is acute, a question of public interest as distinguished from private interest may arise. Fairly satisfactory substitutes are much more available for some of the components than for others. Marine and land boiler fuel can and

[22] Source of table, Davison, George S., President Gulf Refining Co., paper read at the Federal Oil Conservation Board Hearings. Feb. 10, 11, 1926.

will be replaced by coal when the petroleum supply is exhausted. Kerosene is already being rapidly replaced by electricity for lighting, and road oil by concrete. The problem of a satisfactory substitute for motor fuel is not so easily solved.

The question arises whether the conservation of our oil reserves is of sufficient moment to warrant Government intervention in the apportioning of products. For example, should the Government require that of the total output of petroleum the proportion allocated to the not easily replaceable gasoline should approach the maximum (60 percent) while the percentages of the more easily replaceable components should approach the minimum. The matter, however, does not end here. There would be no conservation if the Government simply fixed the proportion—rather the reverse. If the same total quantity of crude oil were taken from the reserves, such an allocation would have the effect of flooding the market with gasoline, which would then sell at a ruinously low price and be wastefully used. Moreover a great many of the smaller refineries are not equipped to utilize the more elaborate processes that such a high yield of gasoline implies. If conservation be the end in view of Government intervention, the total output as well as the allocation of components would have to be brought under control.

The subject is full of difficulties. Government intervention is likely to be cumbersome, irritating, and not always effective. In this case, if such intervention is to be of any avail, action by the Federal Government would seem to be called for; and questions of the constitutional powers of the Fed-

eral Government would at once arise. Doubtless, however, all these difficulties might be overcome. It is a case of balancing evils. Do the exigencies of the petroleum situation warrant the efforts necessary to secure effective Government control?

It is worthy of note that, to a certain extent, the allocation proposed has been self-adjusting under the action of ordinary economic forces. The following figures show the percentages of the total quantities of crude petroleum (domestic and imported) running to the stills, which have been allocated to the principal products for the years specified:

Allocation of crude petroleum to principal refined products, 1916–1930

[In millions of barrels and percentages]

Year	Crude petroleum run to stills			Chief petroleum products							
	Domestic	Foreign	Total	Gasoline		Kerosene		Gas and fuel oils		Lubricants	
				Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percen
1918	------	------	326.0	85.0	26	43.5	10	174.3	53	20.0	6
1919	------	------	361.5	94.2	26	55.7	15	181.6	50	20.2	6
1920	------	------	433.9	116.2	27	55.2	13	211.0	49	24.9	6
1921	------	------	443.4	122.7	27	46.3	10	230.1	52	20.9	4
1922	435.0	65.7	500.7	147.7	29	54.9	11	254.9	51	23.3	5
1923	538.2	43.0	581.2	179.9	31	55.9	10	287.5	49	26.1	4
1924	598.0	45.8	643.8	213.3	33	60.0	9	320.5	50	27.5	4
1925	698.6	41.3	739.9	259.6	35	59.7	8	365.0	49	31.1	4
1926	734.3	45.0	779.3	290.7	38	61.8	8	365.2	47	32.3	4
1927	778.7	50.1	828.8	330.4	40	56.1	7	393.1	47	31.7	4
1928	835.7	77.6	913.3	376.9	41	59.3	6	427.2	46	34.7	4
1929	912.2	75.5	987.7	435.1	44	55.9	6	44.9	45	34.4	3
1930	866.6	60.8	927.4	436.2	47	49.2	5	373.2	40	34.2	3
1932	------	------	------	------	44	------	5	------	38	------	------

Source: World Almanac, 1932, p. 358.

It will be seen that the percentages going to gasoline, the least replaceable of the products, have steadily and rapidly increased, while the percentages going to the more replaceable products, especially kerosene, have shown a marked downward trend. It is doubtful if a more satisfactory result

would follow the most vigorous and irritating regulation by Government.

From the foregoing statement it would appear that the conservation of our petroleum reserves is a matter of serious national concern. What the future may have in store in the way of discovery and invention is conjectural. By hydrogenation, it is possible to make by volume more than 100 percent of gasoline from crude oil. Twenty percent of the motor fuel in Germany is now supplied by hydrogenation of low-temperature distillation of brown coal.

It is feasible to produce gasoline from coal in the United States at prices which the public would pay at perhaps as low as the prices of 10 years ago. The oil shales of the West contain large amounts of oil which can be recovered by distillation, and various processes are available for converting coal into oil, but these alternatives involve higher prices than we have been accustomed to pay. It is also conceivable that some other source of energy as well adapted to our needs as petroleum may be forthcoming. We do not know. But this we do know, that at the present time, with the present stage of advance of the arts and sciences, deprivation of petroleum would be a very serious blow to our national prosperity, if not to our national security. And this we further know, that the years of grace appear to be limited. Just how long it will be before the petroleum reserves of the United States are exhausted is uncertain. It will depend somewhat upon the care exercised in their conservation. But it will not be long, as time is reckoned in the history of nations. And when our own reserves are depleted, even if other countries, exer-

cising more foresight, have husbanded theirs, we cannot expect them to be so simple as to surrender them to us for the strengthening of our air fleet and motor-truck service.

Conservation, therefore, should be prominent in the agenda of State legislatures and the Congress, and in the minds of the leaders of the industry. Their interest, at least their long-run interest, is at one with that of the Nation in this respect.

Two main lines of action are indicated—conservation in use and conservation in production.

CONSERVATION IN USE

One possibility for economy has already been suggested. The output may be restricted to the quantity necessary to supply the least replaceable uses. The process of cracking as was shown, makes possible a considerable range of choice in the final destinations to which the crude petroleum is put. How such restriction is to be put into effect is a difficult problem, but probably not insoluble, if the exigency of the situation be deemed sufficiently imminent. This line of action, if undertaken at all, would probably call for Federal intervention. Such legislation would regulate refinery operations rather than producing operations. Refining is done very largely in States which do not produce crude oil or which produce less crude oil than is refined. This is due to the practice of shipping crude oil by pipe lines and tankers to consuming centers rather than refining it locally where the crude oil is produced. State legislation would be insufficiently comprehensive, and the private interest of the owners and operators is not sufficiently apparent.

A second economy lies in the direction of scientific discovery and invention with a view to securing the maximum possible return in energy from every gallon of gasoline or oil consumed. It is estimated that the ordinary automobile utilizes only some 3½ percent of the energy theoretically lodged in the gasoline.[23] Even now devices have been invented which would considerably increase this percentage, and there would appear here to be an important field for further invention. Motor fuel is one of the most important and least replaceable of the derived products of petroleum. A doubling of the percentage of the theoretical energy actually utilized would be a long step in the direction of conservation.

CONSERVATION IN PRODUCTION

Attention has already been called to the enormous wastes of oil from premature and irregular encroachment of salt water and from the escape into the air of the natural gas that accompanies and causes the flow of petroleum from the sands. Such escape of gas, as was pointed out, is not only a direct loss of the energy embodied in it but is also an indirect loss from the oil which it might have propelled to the surface but did not, because it was permitted to escape. Barring accidents, the occasional occurrence of which seems a challenge to human foresight, all of these wastes should be eliminated.[24]

---

[23] Kettering, C. F., general manager research division, General Motors Corporation, Hearings, Federal Oil Conservation Board, p. 42.

[24] Suman, John R., Petroleum Production Methods. 1921, pp. 227–233.

The fourth report of the Federal Oil Conservation Board devotes considerable space to the subject of pipe lines for conveying natural gas. It is shown that gas can now be conveyed to such great distances and that it is of such value for heating and as a source of power that private interest would seem to dictate every effort to prevent the wasteful escape into the air. But if private interest cannot be relied on to eliminate these wastes from "gushers" and from the escape of natural gas there would seem to be here a field for Government intervention. I believe that the States can adequately police the fields within their respective jurisdictions. The Federal Government might cooperate by lending technical assistance upon request of a State authority.

In the fourth report, however, chief emphasis is given to the wastes from unrestricted competition. The wastes from this source in the east Texas field have already been described. In the judgment of the board unit operation is imperative; that is, that a number of owners whose properties lie over a "pool" should operate as a single owner in some manner sharing in the expense and profit of operation. In general it may be said that it is for the interest of the owners as well as for the public in conserving its oil reserves that such cooperation should be effected. Yet the situation is such that a single owner who refuses thus to cooperate is in a position to make cooperation by the others unavailing. He may lawfully drill a well on any part of his property and appropriate all the oil and gas that he can get from it, notwithstanding the fact that much of the oil and gas thus appropriated lay under his

neighbors' property, and hence under the generally accepted definition of property in real estate would seem to be their property. The case is further complicated by the question of the legal right of the owners to cooperate. If the competitors are engaged in interstate commerce would such combination come under the condemnation of the Sherman Antitrust Act? If not, would the combination come under the condemnation of the common law as a conspiracy in restraint of trade? Can the Government intervene and compel unit operation, or, as in the Texas case, use military force to prevent wasteful competition without violating the constitutional provision against taking property without due process of law?

There are many legal difficulties, but undoubtedly they can be untangled. The powers that make laws or even constitutions can unmake them when the case seems sufficiently pressing. President Coolidge in his letter of December 19, 1924, constituting the Federal Oil Conservation Board, pointed out the impossibility of conserving "oil in the ground under our present leasing and royalty practices, if a neighboring owner or lessee desires to gain possession of his deposits."

In its fourth report the board urges that "The natural unit in oil deposits is a single pool, large or small, and that unit operation is nothing more than accepting nature's decree." It shows that the delimitation of property rights by fences, walls, and the like, however satisfactory in the case of fixed substances like ore or stone, is entirely unsatisfactory in the case of fluids, and concludes that "what is needed now to effect this conservation movement

is specific recognition by the courts of the community of interests of all landowners in the control of the oil or gas pool, in the oil and gas as separate marketable commodities, and in the energy of the gas—the pressure so easily dissipated but so essential to an adequate recovery of the oil included in the minute pores of the sand or sandstone that forms the reservoir."

It points out that much progress has already been made in unit operation but shows that much yet remains to be done. It would seem desirable, in view of the gravity of the situation and the fact that irretrievable wastes of our oil reserves are likely to occur from competitive operation, that whatever is to be done be done quickly.

The facts brought out by this study show that the oil situation involves questions of deep national concern—questions which call for cooperation among leaders in the industry with representatives of the State and Federal Governments to secure conservation of this, one of our most important natural resources. They do not, however, suggest the need of panic or undue alarm. With cooperative action looking to conservation, with improving technique and advancing science in the matter of deeper drilling, more complete recovery of the deposits, and with continued progress in oil geology directed to the study of new deposits, it seems probable that our oil reserves will meet our requirements for many years.

It is possible to forecast for a year in advance the approximate market requirements of the United States as a whole for petroleum and petroleum products. Under present arrangements after such

market requirements have been ascertained it remains for each oil-producing State to decide for itself what share of the total it should supply. After each State has decided what its share of the total should be, it then, under its proration and conservation laws, may allocate this amount to the various oil pools within its jurisdiction. If the individual oil-producing States are fair in their findings as to how much of the total market requirements of the country the given State is entitled to supply, it will be possible for the States to stabilize the production of the flush wells so as to enable the "stripper" wells to continue on pump. If the individual States with the largest producing oil pools substantially overestimate the proportion of the market requirements which a given State for a year should supply, then overproduction of the flush wells under conditions such as obtained in the years 1931–32 might bring down the price of crude oil below where it would be profitable to operate many "stripper" wells.

There are approximately 350,000 wells in the United States producing on an average of 1 to 2 barrels per day. These wells will continue to produce for many years unless they are abandoned. If they should be abandoned on account of the low price of crude oil, the difficulty and expense of restoring the most of them would be prohibitive. A sound conservation policy requires that these wells be permitted to operate continuously. Otherwise much oil would never be brought to the surface, which will be recovered if these "stripper" wells are permitted to run their course without prema-

ture abandonment. From 30,000 of the most productive wells the annual requirements of the United States can be supplied; but to run the newer and stronger wells at a full capacity would mean the abandonment of many of the wells which have to be pumped.

Proration measures are being passed in the States with a view to controlling the output of flush production so that there may be no interference with the wells that are being pumped. If the individual States fail to hold down production in new fields under present conditions, the price of crude oil will force the abandonment of thousands of "stripper" wells.

Compacts between the States with the most productive oil pools may be necessary. If the States will not enter such compacts, and if they persist in overestimating the amount of the annual market requirements which particular States should supply, then there is no way to control production and preserve the thousands of wells that are being pumped except by action of the Federal Government. The States can handle the problem if they will enact and enforce laws with a view to its solution. It remains to be seen how successful they will be in controlling producers within their respective jurisdictions in the interest of conservation throughout the oil-producing areas.

The consumers of oil products for the most part reside in States in which the oil pools are not located. It is to their interest that oil be produced under such conditions as will ultimately lead to recovery of as much oil as possible. If the oil-pro-

ducing States fail in their efforts at conservation, then the oil-consuming States may have to act through the Federal Government to stabilize oil production and conserve oil resources.

[Pages lviii–lix]

RECENT CHANGES IN PIPE-LINE FACILITIES

At the present time three States—Oklahoma, Texas, and California—produce approximately 82 percent of all crude oil taken out of the ground in the United States. In 1930 the Midcontinent output was 66 percent of the total, the California 25 percent, and the Rocky Mountain 4 percent. There is left only 5 percent of the total production to occur in all States east of the Mississippi River, though in this area are found 70 percent of the population, 70 percent of the automobile registrations, and 70 percent of the gasoline consumption.[25] A leading problem confronting the oil industry is therefore that of finding the most economical means of laying down in the great middle west and eastern markets refined products derived from Midcontinent crude. The alternatives are to bring the crude oil by pipe line or by a combination of pipe line and tankers to refining points in the market areas or to refine the oil in the area of its production and move the refined products to the distant markets.

There are many questions other than those of transportation to be faced in choosing between

[25] These figures are taken from the testimony of Chas. E. Bowles at hearing on H. R. 16695, Pipe Lines, Feb. 17 and 18, 1931, pp. 11 to 14.

these alternatives. The relative refining costs in the different areas and the disposition to be made of certain of the refinery by-products, where refining is done at points remote from the large manufacturing or consuming centers, illustrate such questions. For the purpose of this report, however, attention can be confined to the transportation aspects of the problem.

The factors entering into transportation costs have materially changed in recent years, particularly with the development of pipe lines suited to the transportation of gasoline and other refined products and of more economical methods of pipeline construction. Companies whose transportation program was based on earlier cost factors have therefore had to effect adjustments to the changed situation, as by relocating their refineries or changing their refinery schedules, by constructing gasoline lines or converting oil lines to gasoline lines, or otherwise. The accompanying general pipe-line map shows the collective layout of oil and gasoline pipe lines at the present time and the use made of boats from the Gulf to East Coast points, between points within the Gulf area, and from California. The individual maps which accompany the group reports, by isolating the lines and refineries of each group, indicate the choice now in evidence between the alternatives indicated. This choice is not clear-cut in the case of certain of the companies whose field of operation is so large that their transportation program is a composite of types. A brief characterization of some of the leading cases will clarify the discussion.

Mention should first be made of lines in the old eastern field. Many of the lines constructed in the early period when the Appalachian field, especially Pennsylvania, contributed the bulk of the oil of the country, are still in operation. These lines were extended westward as the area of production shifted in that direction, making connection with lines constructed from the Midcontinent field as that area emerged as the most important area of supply. With the development of tanker movements of crude oil and refined products from the Gulf to the East and subsequently from California came a period of difficulty for the lines holding themselves out as parties to the movement of oil from the Midcontinent fields to the east coast and to refinery centers in western Pennsylvania and New York. The present rates of such lines reflect the absorptions they have had to make to prevent further diversions of oil.[26] As is pointed out shortly, the lines embraced in the so-called "Northern" and "Southern" groups, together with the National Transit Co., are not attached to any group of oil companies and hence are practically unique in the pipe-line field to-day.[27]

---

[26] P. LXXIII. One or two such lines now transport crude oil to interior refineries, which has been moved to the east coast by tanker, and others are used for the movements of refined products.

[27] The explanation lies in the fact that these lines were separated from Standard Oil properties in the dissolution of 1911. P. XXXVI.

4. Bureau of Mines, Monthly Petroleum Statement, January, 1934:

[Page 4]

Production of crude petroleum by States and principal fields

(Thousands of barrels of 42 gallons)

	January 1934		December 1933		January 1933	
	Total	Daily average	Total	Daily average	Total	Daily average
Arkansas	956	31	942	30	943	30
California:						
Kettleman Hills	1,597	52	1,656	54	1,795	58
Long Beach	1,806	58	1,896	61	2,125	69
Santa Fe Springs	1,283	41	1,307	42	1,694	55
Rest of State	9,477	306	9,867	318	8,846	284
Total California	14,163	457	14,726	475	14,460	466
Colorado	87	3	77	3	88	3
Illinois	393	13	378	12	297	9
Indiana:						
Southwestern	72	2	69	2	48	2
Northeastern					1	
Total Indiana	72	2	69	2	49	2
Kansas	3,407	110	3,470	112	2,933	95
Kentucky	362	12	385	12	438	14
Louisiana:						
Gulf coast	1,351	44	1,358	44	1,036	33
Rest of State	852	27	768	25	876	29
Total Louisiana	2,203	71	2,126	69	1,912	62
Michigan	822	27	945	30	447	14
Montana	222	7	199	6	169	5
New Mexico	1,319	42	1,277	41	1,003	32
New York	306	10	298	10	253	8
Ohio:						
Central and eastern	269	8	255	8	273	9
Northwestern	89	3	79	3	86	3
Total Ohio	358	11	334	11	359	12
Oklahoma:						
Oklahoma City	5,589	180	5,932	191	3,221	104
Seminole	3,311	107	3,308	107	3,404	110
Rest of State	6,318	204	5,968	193	5,857	189
Total Oklahoma	15,218	491	15,208	491	12,482	403
Pennsylvania	1,152	37	1,077	35	974	32
Tennessee	1				1	
Texas:						
Gulf coast	4,913	158	4,873	157	3,814	123
West Texas	3,994	129	3,931	126	4,960	160
East Texas	13,989	451	13,901	449	10,447	337
Rest of State	6,790	219	6,619	214	6,665	215
Total Texas	29,686	957	29,324	946	25,886	835
West Virginia	340	11	326	11	294	9
Wyoming:						
Salt Creek	524	17	558	18	666	22
Rest of State	385	12	341	11	344	11
Total Wyoming	909	29	899	29	1,010	33
United States total	71,976	2,321	72,060	2,325	63,998	2,064

5. Minerals Yearbook 1932–1933, Statistical Appendix:

[Page 335]

Producing oil wells

State	Approximate number, Dec. 31, 1932	Average production per well per day (barrels)
Arkansas	2,880	10.7
California	8,900	54.7
Colorado	190	15.9
Illinois	15,170	.8
Indiana:		
Southwestern	1,140	1.9
Northeastern	365	.2
Total Indiana	1,505	1.4
Kansas	18,300	5.1
Kentucky	13,510	1.3
Louisiana:		
Gulf Coast	390	83.5
Northern	2,660	10.2
Total Louisiana	3,050	19.1
Michigan	645	29.6
Montana	1,420	4.7
New Mexico	490	74.0
New York	17,680	.5
Ohio:		
Central and eastern	20,640	.5
Northwestern	13,890	.2
Total Ohio	34,530	.4
Oklahoma	57,100	7.4
Pennsylvania	80,380	.4
Texas:		
Gulf Coast	2,740	42.9
East Texas proper	9,400	51.3
West Texas	3,090	57.0
Rest of State	28,400	8.2
Total Texas	43,630	21.0
West Virginia	18,850	.6
Wyoming	3,200	11.1
Other	(1) 70	---------- ----------
	321,500	6.7

[1] Alaska, Missouri, Tennessee, and Utah.

6. American Institute of Mining and Metallurgical Engineers, *Petroleum Development and Technology, 1931,* Swensrud, Economics of Distribution in the Oil Industry:

[Page 604]

The economics of distribution in the oil industry cannot be regarded apart from the general economics of the industry as a whole. The attempt to regard them as separate has led many people into the fallacy of believing that the responsibility for the apparent evils in the marketing end of the business lay entirely at the door of the marketing end. Such a view fails to take cognizance of many underlying factors; we can only expect to understand the distribution economics of the industry if we understand its general economics. We must realize also that the oil industry today is essentially the gasoline industry.

The oil industry may be said to have begun about 60 years ago. At the outset it was concerned chiefly with the manufacture and sale of kerosene, lubricating oils, and greases. Gasoline was then a most obnoxious byproduct. The early oil-marketing company was engaged almost exclusively in refining and marketing—it did not concern itself with production but bore the relation to it merely of a purchaser. It may be said that the urge of marketing development in those days, therefore, came from the refining and marketing end of the business. The raw material had not yet begun to exert its enormous pressure, nor had the producer of crude oil acquired a direct interest in the sale of the ultimate finished products.

Since then great changes have taken place. With the development of the automobile came a vast new demand for the raw material from which gasoline could be made. No longer could the refining and

marketing companies be indifferent to the source of that raw material, particularly in view of the pessimistic outlook then presented as to the probable quantity of oil in existence. And despite the complete overturning of those early estimates, made before the bounty of nature and the skill of geologists and mining engineers had revealed themselves in undreamed of reserves of crude oil, the motive of the large marketer to integrate back to the crude still constitutes a strong force. The need of uniform and assured quality, made the more necessary by intensive advertising, tends to force him into refining. Then it may seem expedient for him to secure production in order to protect his refining and marketing position, although often he is merely attracted by the hope of reaping a profit on the raw material for which the sale of his finished product and his refining position give him a justifiable use.

The production of crude, however, was not in the beginning and never has been confined to refining and marketing companies. Many companies began at the production end. The abundance of crude of which many of these companies found themselves possessed has in turn, however, exerted upon them a powerful pressure to engage in refining and marketing activities in order to obtain for their production a more assured outlet. It is sometimes difficult or impossible to sell crude oil as such, but there is almost always a possibility of selling gasoline, at some price. So the producer of crude becomes a refiner; then, as he still finds it difficult to dispose of all his gasoline at wholesale for a decent

price, he tends to push on into the retail marketing end in order to obtain that final utopia of assured outlets.

[Page 609]

For few commodities probably are prices less understood than for gasoline. Legislators and editors frequently feel that laws should be passed about them, apparently on the general theory that what is a mystery to them ought to be dealt with by law. People express great amazement that the price of gasoline at one point should differ sharply from that at a nearby point. Likewise, they see something mysterious if not sinister when practically all major companies raise or lower their posted prices simultaneously. Beneath these surface indications regarding price are some simple and some rather complicated economic factors.

The general level of gasoline price is fundamentally determined by the interaction of gasoline demand and crude-oil supply. In a very narrow and short-term sense, the price of gasoline reacts to the supply and demand factors for gasoline alone, but in our industry the rapidity with which crude oil can be converted into gasoline makes the supply of crude the dominant factor. The facts bear out this statement, for over a period of the last 12 years there never has been a major change in the trend of wholesale gasoline prices that was not followed shortly by a change in the same direction in crude oil. The statement just made that changes in crude-oil prices follow changes in wholesale gasoline

prices is a true statement of the actual sequence. It is a logical sequence because the wholesale gasoline market is an extremely sensitive one, whereas the market for crude oil is rather sluggish, owing to the physical necessity, in general, of pipe-line connections with a specific buyer. It is not a market in which buyers and sellers can meet openly on equal terms and engage in that "higgling and bargaining" which are the essentials of a market in which the forces of supply and demand can rapidly and continuously be balanced in terms of price. This simply means that the wholesale gasoline price, being more sensitive, tends to reflect sooner those supply and demand factors to which the price of crude must later respond.

The retail price of gasoline, as has been mentioned, tends to lag behind the wholesale price because there is less higgling and bargaining by the retail buyer, and perhaps also because the inconvenience of fractional cent retail prices tends to cause a postponement of retail price changes until enough change in wholesale prices has accumulated to warrant a change of convenient amount in the retail price.

The close correspondence of retail gasoline prices and price changes among leading companies is the result of economic necessity and not of collusion. The commodity gasoline, to be sure, is bought to a considerable extent on the basis of brand, but the normally small differences in quality which usually have existed between the products of good companies, and the difficulty of readily apprehending the differences in a motor car, have made the cus-

tomer, as a general rule, unwilling to pay more for his preferred brand than for the comparable brand of another company. Suppose, therefore, that today a certain leading marketer cuts the price 2 cents. No other representative company could afford not to cut, unless it were willing to risk losing much of its business. Likewise, on the upside, a leading company raises its price, say, 1 or 2 cents. In this case, if its competitors do not follow its lead it would have no option but to reduce its price back to their level or lose business. These factors practically compel all companies having reasonably comparable products and service to sell at the same retail price—the same thing is true of most other products we buy, with this difference however: A large portion of the public buys gasoline frequently; those buyers are mobile—being in their automobiles they can readily drive a little out of their way if any price advantage makes that desirable.

Then, too, gasoline is the principal product sold at a gasoline station, and prices usually are posted very conspicuously, especially if they are lower than the prevailing level, so that the opportunities for price comparison by the customers are almost unparalleled. These factors simply narrow down the time limit the various companies have in which to adjust their prices to prevailing levels, and any oil marketer knows that if a cut price is suddenly posted by a nearby competitor he begins to suffer serious and immediate loss of gallonage. The result is what may be called a follow-the-leader price

custom among gasoline companies marketing on a comparable basis.

[Page 613]

It is usually accepted that there is nothing the oil marketer can do materially to affect the total gasoline consumption. His only hope is to secure a greater proportion of the existing demand.

[Page 615]

We may summarize the economics of gasoline marketing by reiterating that through it all the motivating force of crude oil pressing for a market can be seen. We have watched the mechanism for the exertion of that pressure develop from the stage when the pressure was relatively indirect, because production was not linked with refining and marketing,—to the present stage when a high degree of integration has made for an exceedingly direct conduit of the pressure, and when in addition the jobber and the tank-car service station have been developed to a point where they quickly adjust any unduly wide margins between delivered cost and retail prices.

We see the pressure for sales of gasoline breaking out in increased outlets, in various forms of price cutting and in increased marketing costs. With the growing integration of oil companies, more and more of the profits of other ends of the business are, the author believes, being pushed over into the marketing end, to be used there in the struggle for outlets.

7. National Petroleum News, June 1, 1932.—Holliday, *Narrower Margins Essential:*

[Pages 25–28]

The marketing end of the business cannot separate itself from the production and refining parts as though it were a separate industry. All three departments constitute one single industry, and economic effects usually are manifested first in the marketing end. Gasoline prices have been the barometer of fundamental economic conditions and reflect conditions not only in the marketing department but in the refining and producing ends.

It does not lie within the power of the marketing branch of the industry to control prices of finished products. In the absence of monopoly or governmental control or assistance, prices are made by markets and not by individuals, and markets reflect all of the subtle economic forces that are at work. * * *

Gasoline prices have been reflecting the fundamental overproduction: Overproduction of potential supply of crude oil, overproduction of potential refinery capacity, and overproduction of marketing facilities which resulted from overproduction of crude oil and refining capacity.

The production and refining ends of the business have not put their house in order, and cannot do so as long as the present law of oil and gas remains unchanged. The fundamental supply factor is not aboveground storage alone, but the total inventory of all products including the crude oil which lies below the ground and can be brought to the surface by the turning of a valve.

* * * * *

On account of the liquid nature of crude oil and the character of modern continuous refinery process, the potential supply of crude oil below the earth is part of the gasoline supply, and so long as the fear exists as to the possibility of the dam breaking which holds back that supply, the sensitive tank-car gasoline market will continue to be low. Even the supply of crude oil above ground is sufficient to keep prices depressed.

We lay so much stress upon the statistics of gasoline inventory, and seem to ignore the fact that crude-oil inventory stored above ground, to the extent of its gasoline yield, is practically the equivalent of a gasoline inventory, since it can be so quickly converted into gasoline. Even if we ignore potential supply, the inventory of crude oil above ground is approximately six times the total gasoline inventory, so that our real gasoline supply above ground is approximately four times as large as our gasoline inventory statistics would indicate.

In a time of scarcity or anticipated scarcity of potential production, or in a time when potential production is reasonably in balance with current demand, the crude-oil inventories above ground would constitute a reasonable reserve which would not necessarily enter into the supply factor; but at a time like the present, even if we ignore the potential supply below ground, the actual crude inventories in storage are in essence a part of our gasoline inventory and indicate a supply factor so large as to necessitate low prices in a free and open market. I do not mean to disparage the worthy effort to reduce gasoline inventory but merely am trying

to emphasize that it is only one part of the supply factor.

This, in my judgment, is why, no matter what is done in the producing States in the way of maintenance of crude oil prices, the gasoline market continues to be low. Any company which attempts to take the high ground of ignoring markets and basing its gasoline prices upon posted crude-oil prices may do so if it pleases, but in doing so it will surrender the market to others; and a market once lost is not easily regained.

Gasoline prices have been the barometer of fundamental economic conditions because they are in a market which is open and free, and when crude oil prices have not synchronized with gasoline prices it has been because the crude-oil market is by nature more sluggish and subject to control, and has not reflected fundamental conditions.

In the last analysis the battle ground of this industry is in the marketing end, because the only purpose of producing a raw material is to supply the finished products which the marketing department can sell; and, therefore, the fundamental economic conditions of production must have their logical effect out on the marketing firing line.

* * * Gasoline produced from low-priced crude oil, however, and distress gasoline resulting from overproduction, forced itself upon the market in such quantity at price-cuts below these companies' cost, based on posted crude-oil prices, until in the last few years it has come to be recognized and practiced that retail prices must be based, not

upon current cost, but upon the wholesale tank car or cargo markets.

II. COSTS OF PRODUCTION AND AVERAGE PRICES RECEIVED

1. United States Tariff Commission Report to the House of Representatives on *Crude Petroleum and its Liquid Refined Products,* Report No. 30, Second Series [pp. 158–163]:

TABLE 86.—*Crude petroleum: Unit cost of production and unit sales price, by districts, 1927–1930*

GROUP I. LARGE COMPANIES

District	1927			1928			1929			1930			4-year weighted average	
	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Unit cost including interest on investment	Unit sales price
California:	*Barrels*			*Barrels*			*Barrels*			*Barrels*				
Long Beach, Seal Beach, Signal Hill	18,962,688	$0.60	$1.05	33,266,829	$0.62	$1.00	35,030,137	$0.55	$1.13	19,319,393	$0.65	$1.24	$0.60	$1.11
Santa Fe Springs	5,081,385	.71	1.18	6,223,159	1.59	1.22	49,583,200	.92	1.32	31,563,779	.88	1.42	.94	1.37
Redonda-Torrance	3,732,717	.89	1.11	2,825,232	.90	1.08	2,388,467	1.06	.87	2,864,138	1.18	.88	.99	1.00
Coalinga (light)	1,231,736	1.06	.83	482,082	2.05	.76	119,508	5.91	.60	1,673,197	1.55	.57	1.59	.64
Coalinga (heavy)	1,009,920	1.06	.76	997,334	1.15	.77	1,802,137	1.07	.54	864,769	1.10	.54	1.09	.63
Huntington Beach	5,026,280	.70	1.02	3,476,154	.82	.90	2,721,460	.92	.89	7,546,325	.57	1.10	.70	1.01
Kern River, Kern River Front, Mount Poso, Round Mountain	2,286,905	1.87	.79	2,021,495	1.78	.68	4,338,078	1.02	.51	6,035,868	.91	.54	1.21	.59
Elks Hills, McKittrick	1,310,503	.40	.81	1,234,808	.37	.80	1,087,598	.42	.66	4,373,375	.39	.73	.39	.74
Lawndale, Potreto, Rosecrans	1,105,752	1.06	1.57	857,593	1.68	1.52	1,100,388	1.53	1.70	1,177,085	1.20	1.84	1.35	1.67
Dominquez	3,481,436	.59	1.18	2,438,057	.87	1.12	1,983,329	.84	1.25	2,056,467	.72	1.34	.74	1.21
Beldridge, Lost Hills	1,197,385	1.09	.93	1,128,535	.96	.86	1,240,581		.83	1,037,204	1.18	1.20	.73	.95
Ventura (Avenue)	13,649,364	.25	1.10	14,065,679	.50	.99	18,180,025	.60	1.14	15,349,756	.57	1.26	.49	1.13
Buena Vista, Maricopa, Midway, Sunset, Wheeler Ridge	10,769,904	.75	.71	8,857,218	.88	.89	8,313,770	.79	.79	14,246,210	.99	.99	.86	.86
Culver City, Inglewood, Montebello, Whittier	2,169,047	.63	.96	1,691,413	.76	.72	1,356,601	.95	.86	4,724,817	.53	.86	.65	.88
Arro Grande, Casmalia, Cat Canyon, Lompoc, Santa Maria	210,443	1.36	.95	195,788	1.33	.91	169,896	1.73	.91	182,424	2.34	.97	1.67	.93
Bardsdale, Conejo, Newhall, Ojai, Peru, Santa Paula	14,908	.98	.87	25,540	2.72	.85	70,957	1.48	.86	169,622	1.49	.97	1.57	.93
Brea-Olinda, Coyote Hills, East Coyote, West Coyote, Olinda, Richfield	6,418,932	.71	1.03	5,287,967	.74	.96	4,698,572	.85	.99	3,630,081	1.05	1.04	.81	1.01
Alamitos	256,143	2.83	.95	178,683	.72	1.01	1,144,396	.59	1.19	347,097	.95	1.30	.96	1.16
Kettleman Hills				2,663	.26	1.00	639,204	1.50	1.50	4,891,885	.06	1.51	.23	1.51
Baldwin Hills, La Habra, Merced Hills, and all other	3,170,538	1.18	.93	2,472,406	1.18	.91	4,163,123	1.09	.83	8,843,356	1.03	.95	1.09	.92
Santa Barbara Beach fields				572,174	1.20	1.44	7,896,239	.34	1.44	10,843,435	.38	1.40	.38	1.42
Total	81,085,986	.69	1.00	88,300,809	.81	1.01	148,027,656	.76	1.14	141,740,283	.75	1.18	.75	1.10

Texas:														
Panhandle	17,920,123	1.52	1.00	11,635,267	1.30	1.00	16,999.774	1.00	1.30	14,100,547	1.01	1.15	1.21	1.12
West Texas	25,270,941	.89	.76	71,303,584	.59	.63	78,568,927	.46	.78	69,968,787	.56	.79	.57	.73
North Texas	11,613,698	1.77	1.43	10,986,866	1.50	1.37	14,813,151	1.25	1.41	9,740,364	1.31	1.25	1.45	1.37
Mexia	8,498,240	1.87	1.45	5,724,868	2.23	1.38	4,966,783	2.18	1.43	10,633,184	1.35	1.16	1.81	1.33
Luling	5,627,182	1.14	1.10	4,887,200	1.35	1.04	13,654,963	.93	1.07	11,578,812	.90	1.02	1.01	1.05
North Central Texas	10,735,960	1.66	1.53	11,851,836	1.29	1.37	14,134,885	1.23	1.74	10,339,413	1.19	1.23	1.33	1.49
East Texas	29,729	.64	1.45	30,048	14.27	1.43	28,113	7.93	1.47	26,594	4.07	1.30	8.30	1.41
Southwest Texas	1,014,517	1.57	1.07	1,213,504	1.35	1.01	1,350,281	1.40	.87	3,890,967	.96	1.06	1.18	1.02
Iatan	510,240	1.34	1.08	1,060,534	.91	.71	1,022,638	.91	.76	611,444	1.05	.71	1.00	.79
Gulf coast	36,532,871	.86	1.41	32,486,052	.93	1.18	37,681,123	1.03	1.25	41,307,760	1.02	1.14	.97	1.24
Big Lake	5,751,665	.64	1.26	4,612,982	.84	1.16	3,911,725	.68	1.28	4,036,556	.68	1.21	.71	1.23
Corsicana (heavy)	107,987	2.44	1.09	88,450	1.46	1.01	80,435	1.06	.82	144,794	1.39	1.13	1.61	1.04
Mixed districts and others in Texas	5,051,133	.98	.99	6,429,652	.80	.78	7,281,079	.72	1.15	7,348,354	.80	1.00	.81	.98
Total	128,663,286	1.19	1.20	162,310,843	.93	.93	194,493,877	.81	1.12	183,727,576	.87	1.00	.93	1.06
Oklahoma:														
Bartlesville and Nowata, Rogers, Craig, Dewey, and Washington Counties	1,126,292	2.82	1.30	1,163,458	2.35	1.19	1,339,591	2.31	1.26	1,101,842	1.82	1.12	2.33	1.22
Tulsa and Creek Counties	4,607,378	1.59	1.37	3,887,704	1.63	1.28	4,116,021	1.52	1.30	3,197,036	1.64	1.22	1.59	1.30
Wagoner, Muskogee, and McIntosh Counties	87,080	2.55	1.37	[illegible]	3.76	1.32	257,379	1.64	1.43	175,042	1.17	1.35	1.75	1.38
Okmulgee, Okfuskee, and Hughes Counties	2,443,299	1.62	1.45	1,[illegible]36,805	1.80	1.45	1,821,696	1.96	1.53	1,305,534	3.00	1.28	1.99	1.44
Seminole and Pottowatomie Counties	5,150,183	1.24	1.58	5,594,250	1.27	1.59	4,740,482	1.48	1.49	6,873,809	1.41	1.31	1.35	1.39
Osage County	7,052,016	1.64	1.43	6,368,412	1.72	1.37	4,648,835	1.80	1.40	4,193,603	1.75	1.26	1.72	1.37
Pawnee, Payne, and Lincoln Counties	3,450,762	1.[illegible]	1.47	2,520,862	1.71	1.43	2,238,700	1.82	1.50	2,776,511	1.91	1.35	1.78	1.44
Kay, Noble, Garfield, and Grant Counties	14,247,343	1.14	1.58	8,731,266	1.24	1.57	6,708,519	1.23	1.49	4,930,396	1.25	1.45	1.20	1.54
Caddo, Grady, Comanche, and Garvin Counties	255,612	1.70	1.31	205,110	2.10	1.18	347,390	1.47	1.12	881,906	1.32	1.05	1.50	1.12
Stephens, Cotton, Carter, and Jefferson Counties	5,771,004	1.41	1.30	5,442,718	1.40	1.18	11,600,101	1.23	1.33	5,539,264	1.22	1.08	1.30	1.24
Burbank field	5,195,551	1.51	1.47	3,154,364	1.64	1.36	2,169,859	1.38	1.41	1,553,273	1.47	1.28	1.51	1.39
Cushing field	5,343,123	1.23	1.48	4,448,530	1.24	1.48	3,903,137	1.36	1.54	3,363,905	1.53	1.36	1.32	1.47
Oklahoma City field				74,071	.71	1.41	3,879,039	.91	1.52	19,746,013	1.20	1.30	1.15	1.34
Healdon field	4,530,975	1.09	1.20	4,882,073	1.09	1.23	4,213,848	.99	1.09	3,895,882	.90	1.01	1.02	1.09
Seminole field	84,499,153	1.01	1.41	81,405,249	.94	1.43	85,635,218	1.04	1.49	60,974,109	1.05	1.36	1.01	1.42
All other districts in Oklahoma	41,740,249	1.30	1.43	35,046,425	1.11	1.29	33,585,048	1.13	1.42	15,079,830	1.31	1.28	1.21	1.37
Total	185,500,029	1.20	1.42	164,942,654	1.12	1.38	171,204,863	1.16	1.45	135,587,955	1.22	1.31	1.18	1.39
Kansas:														
Eldorado-Augusta	7,705,644	1.63	1.39	7,376,871	1.61	1.32	9,926,928	1.45	1.46	10,314,482	1.56	1.29	1.56	1.37
Greenwood and Woodson Counties	3,975,872	1.43	1.47	3,827,837	1.60	1.43	3,902,746	1.59	1.53	3,749,119	1.54	1.36	1.54	1.45
East Kansas	727,562	1.90	1.39	788,973	1.68	1.30	1,132,869	1.39	1.36	1,541,305	1.21	1.23	1.46	1.31
Russell County	426,520	1.40	1.50	277,930	1.93	1.40	266,861	1.98	1.42	147,714	2.46	1.06	1.81	1.40
Wichita	92,330	1.56	1.47	612,024	.98	1.44	3,791,663	1.03	1.65	3,714,779	1.06	1.45	1.05	1.54
Sumner County	6,871,003	1.22	1.37	6,146,755	1.09	1.35	1,297,787	1.30	1.48	1,736,201	1.34	1.35	1.19	1.37

TABLE 86.—*Crude petroleum: Unit cost of production and unit sales price, by districts, 1927–1930*—Continued

GROUP I. LARGE COMPANIES—Continued

District	1927			1928			1929			1930			4-year weighted average	
	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Unit cost including interest on investment	Unit sales price
Kansas—Continued.	*Barrels*			*Barrels*			*Barrels*			*Barrels*				
Lyon County	37,556	$1.04	$1.51	20,295	$1.70	$1.45	12,767	$1.39	$1.52	9,024	$2.48	$1.36	$1.43	$1.48
Rice County and Hutchinson district	105,592	2.67	1.32	70,687	2.22	1.19	2,236,690	.49	1.41	1,642,301	1.15	1.26	.85	1.34
Total	19,942,079	1.46	1.40	19,121,372	1.43	1.35	22,568,311	1.30	1.49	22,854,925	1.41	1.33	1.40	1.40
Arkansas:														
Eldorado	8,281,913	.93	1.07	7,127,189	1.03	.89	5,805,872	1.54	.94	4,857,676	1.22	.93	1.11	.96
Smackover	11,658,430	.91	1.02	8,983,288	.95	.79	7,520,511	.96	.84	5,969,449	1.06	.87	.96	.89
Total	19,940,343	.92	1.04	16,110,477	.99	.83	13,326,383	1.14	.88	10,827,125	1.13	.90	1.02	.92
Louisiana:														
Bull Bayou	499,568	2.14	1.46	664,779	1.50	1.39	668,254	1.85	1.42	598,290	2.67	1.59	2.02	1.41
Haynesville	11,280,897	1.30	1.18	9,011,244	1.37	1.09	7,188,880	1.59	1.14	8,288,498	1.47	1.14	1.42	1.14
Caddo	2,616,598	1.59	1.45	2,135,185	1.63	1.39	2,057,655	1.59	1.48	1,095,650	1.64	1.23	1.61	1.41
Gulf coast	2,198,727	1.48	1.12	3,779,954	1.17	1.12	3,601,472	1.38	1.22	4,583,606	1.30	1.06	1.32	1.13
Total	16,595,790	1.40	1.22	15,591,182	1.36	1.15	13,516,261	1.55	1.23	14,566,044	1.48	1.13	1.44	1.18
Wyoming:														
Salt Creek	193,375	1.89	1.40	197,228	1.94	1.29	316,794	2.60	1.43	442,294	4.84	1.28	3.23	1.34
Big Muddy	151,043	.74	1.35	129,101	.64	1.29	368,777	1.77	1.41	91,918	.48	1.31	1.21	1.37
Grass Creek	574,651	.72	1.44	514,849	.58	1.39	483,000	.70	1.54	433,013	.61	1.48	.65	1.46
Rock River	530,762	.78	1.35	504,870	.71	1.29	528,706	.66	1.33	423,819	.36	1.28	.64	1.31
All other districts	1,152,925	1.21	1.14	1,525,473	.82	1.04	1,653,580	.89	1.05	2,196,907	1.23	.97	1.05	1.03
Total	2,602,756	1.03	1.28	2,871,521	.83	1.17	3,350,857	1.08	1.24	3,587,951	1.58	1.19	1.16	1.22

TABLE 87.—*Crude petroleum: Unit cost of production and unit sales price, by districts, 1927–1930*

GROUP II. SMALL COMPANIES

District	1927			1928			1929			1930			4-year weighted average	
	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Unit cost including interest on investment	Unit sales price
California:	*Barrels*			*Barrels*			*Barrels*			*Barrels*				
Long Beach, Seal Beach, Signal Hill	1,648,326	$0.97	$1.05	3,712,096	$1.05	$1.06	4,955,792	$0.99	$1.08	3,953,593	$1.00	$1.27	$1.01	$1.12
Santa Fe Springs	432,203	.73	.98	362,953	1.86	1.26	1,171,947	1.95	1.29	1,394,852	1.04	1.37	1.41	1.26
Redonda-Torrance	323,906	1.28	.93	215,331	1.26	.84	247,636	1.37	.40	155,601	1.53	.82	1.34	.82
Coalinga (light)	190,344	.86	.78	156,821	.71	.74	145,641	.62	.56	189,777	.68	.55	.72	.66
Coalinga (heavy)	188,005	.83	.91	170,191	.83	.74	163,735	.77	.60	100,295	.67	.53	.79	.72
Huntington Beach	871,763	1.06	1.09	592,361	.87	.87	516,994	1.43	.96	606,622	1.50	.97	1.19	.99
Kern River, Kern River Front, Mount Poso, Round Mountain	831,389	.90	.77	942,827	.83	.73	762,922	1.17	.68	490,790	1.12	.54	.98	.70
Elk Hills, McKittrick	100	179.44	1.92	102,633	1.38	.75	120,389	.98	.53	117,465	.90	.54	1.07	.60
Lawndale Potrero, Rosecrans				1,256	34.91	1.59	49,772	.95	1.02	173,775	2.52	1.78	2.43	1.61
Belridge, Lost Hills										93,829	.34	.55	.34	.55
Ventura (Avenus)	220,503	1.30	1.41	179,859	.72	1.13	348,095	2.57	1.18	315,739	1.28	1.21	1.61	1.23
Buena Vista, Maricopa, Midway Sunset, Wheeler Ridge	1,342,517	1.32	.81	1,581,598	1.09	.78	1,843,531	1.04	.66	1,549,341	.97	.71	1.10	.73
Culver City, Inglewood, Montebella, Whittier	24,910	.89	.85	23,411	.91	.85	22,226	.83	.71	22,293	.86	.67	.87	.77
Arro Grande, Casmalia, Cat Canyon, Lompoc, Santa Maria	472,079	.97	.81	408,812	1.17	.77	158,159	1.96	.63	87,441	2.04	.49	1.26	.74
Bardsdale, Conejo, Newhall, Ojai, Peru, Santa Paula	39,268	1.76	1.14	62,737	1.06	.77	37,000	2.04	1.08	34,329	2.41	.97	1.70	.96
Brea-Olinda, Coyote Hills, East Coyote, West Coyote, Olinda, Richfield	1,073,742	1.03	1.01	1,294,808	1.09	.98	1,416,333	.78	1.04	1,241,410	.66	1.06	.88	1.02
Baldwin Hills, La Habra, Merced Hills, and all other	292,050	.26	.85	800,536	.64	.81	696,850	.46	.90	265,739	1.22	.75	.60	.84
Santa Barbara Beach fields				178,488	1.61	1.08	236,886	.90	1.07	534,416	.38	1.37	.74	1.24
Total	7,951,105	1.02	.95	10,786,718	1.04	.92	12,893,908	1.12	.96	11,327,307	1.01	1.09	1.05	.98

TABLE 87.—*Crude petroleum: Unit cost of production and unit sales price, by districts, 1927–1930*—Continued

GROUP II. SMALL COMPANIES—Continued

District	1927			1928			1929			1930			4-year weighted average	
	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Production	Unit cost including interest on investment	Unit sales price	Unit cost including interest on investment	Unit sales price
Texas:	*Barrels*			*Barrels*			*Barrels*			*Barrels*				
Panhandle	2,429,736	$0.84	$0.90	1,641,178	$0.91	$1.01	1,508,442	$0.97	$1.24	1,623,081	$1.51	$1.00	$1.03	$1.02
West Texas	2,136,351	.32	.35	2,783,203	.47	.58	1,618,178	1.10	.96	2,347,937	1.42	.78	.80	.64
North Texas	1,822,058	1.30	1.45	1,414,138	1.76	1.42	1,833,667	1.59	1.45	1,753,532	1.36	1.22	1.49	1.38
Mexia, Wortham	205,596	.98	1.39	296,539	1.36	1.27	301,523	1.34	1.35	152,550	1.20	1.29	1.24	1.33
Luling, Bruner	97,697	1.61	1.41	65,459	1.58	1.29	52,999	1.64	1.34	46,766	1.62	1.20	1.61	1.33
North Central Texas	449,005	1.95	1.39	435,977	1.72	1.40	376,880	1.72	1.47	1,076,666	1.34	1.28	1.59	1.35
East Texas	34,536	1.52	1.61	24,181	1.57	1.58	25,257	1.59	1.69	20,810	1.61	1.41	1.56	1.58
Southwest Texas	57,871	.64	1.10	48,100	.89	1.00	41,882	.82	.84	190,215	.88	.79	.83	.88
Gulf Coast	569,621	1.20	1.16	526,807	1.59	1.27	450,347	1.64	1.21	692,506	1.35	.95	1.43	1.13
All others	92,443	1.74	1.75	109,205	1.61	1.34	202,342	1.67	1.13	309,814	1.18	.94	1.46	1.16
Total	7,894,914	.92	.96	7,344,787	1.04	.99	6,411,517	1.32	1.24	8,213,877	1.39	1.02	1.16	1.04
Oklahoma:														
Bartlesville and Nowata, Rogers, Craig, Dewey, and Washington Counties	6,888	1.41	1.31	611,854	1.34	1.22	592,920	1.26	1.28	808,145	1.13	1.13	1.27	1.23
Tulsa and Creek Counties	389,410	1.61	1.37	330,197	1.37	1.25	360,754	1.26	1.26	246,232	1.46	1.17	1.43	1.27
Wagoner, Muskogee, and McIntosh Counties	11,623	2.02	1.55	10,559	1.96	1.43	10,335	1.76	1.52	16,420	1.71	.96	1.85	1.32
Okmulgee, Okfuskee, and Hughes Counties	93,889	.73	1.70	90,227	1.35	1.42	96,477	.14	1.43	94,956	1.51	1.35	.92	1.48
Seminole and Pottawatomie Counties	9,920	2.16	1.71	36,412	2.56	1.42	171,909	1.42	1.53	80,088	1.64	1.31	1.65	1.46
Osage County	450,206	1.16	1.36	552,511	1.07	1.24	571,496	.96	1.28	525,242	.92	1.16	1.02	1.26
Pawnee, Payne, and Lincoln Counties	238,112	2.25	1.50	190,679	2.19	1.39	47,197	2.36	1.45	134,861	1.98	1.34	2.18	1.43
Kay, Noble, Garfield, and Grant Counties	67,085	1.36	1.55	51,227	.34	1.56	152,164	.83	1.61	268,141	1.33	1.37	1.10	1.48
Caddo, Grady, Commanche, and Harvin Counties	32,132	2.58	1.14	40,448	1.60	.74	33,181	.57	.75	17,934	1.58	.62	1.57	.83
Stephens, Cotton, Carter, and Jefferson Counties	230,844	1.61	1.30	201,594	1.55	1.18	273,063	1.56	1.24	175,087	1.08	1.11	1.47	1.22
Cushing field	557,078	.88	1.71	526,287	1.10	1.48	589,802	1.06	1.55	596,559	.84	1.44	.96	1.53

Oklahoma City field	546,388	1.08	1.25	497,997	.85	1.13	657,606	1.09	1.62	2,216,371	1.66	1.31	1.53	1.38
Healdton field	1,105,702	.88	1.41	452,572	1.03	1.44	454,813	.76	1.14	421,117	.66	1.05	.85	1.15
Seminole field	117,990	1.67	1.49	193,158	1.49	1.47	674,654	1.09	1.42	313,472	1.11	1.36	.99	1.41
All others							102,357	1.82	1.46	120,600	2.41	1.61	1.80	1.51
Total	4,417,267	1.22	1.41	3,785,722	1.23	1.30	4,788,728	1.11	1.39	6,035,225	1.33	1.27	1.23	1.34
Kansas:														
Eldorado-Augusta, Butler County	71,546	.82	1.38	51,691	.92	1.26	44,485	1.09	1.31	52,191	1.47	1.16	1.05	1.29
Greenwood and Woodson Counties	256,644	.85	1.53	166,968	1.07	1.45	114,346	1.59	1.51	98,709	1.72	1.36	1.18	1.48
East Kansas	179,620	1.98	1.27	210,517	1.65	1.20	226,148	1.43	1.23	208,283	1.28	1.12	1.57	1.20
Cowley and Sumner Counties	365,602	1.34	1.48	229,532	1.42	1.47	243,665	1.29	1.54	194,101	1.30	1.39	1.34	1.47
Lyon and Chase Counties										3,763	9.11	1.35	9.11	1.35
Rice and Reno Counties, Hutchinson district	9,989	2.29	1.51	7,653	2.35	1.47	6,386	2.41	1.55	7,214	1.96	1.37	2.25	1.48
Total	883,401	1.29	1.44	666,361	1.38	1.36	635,030	1.39	1.41	564,261	1.44	1.26	1.37	1.38
Arkansas:														
Eldorado	497,133	.84	1.16	339,061	.89	.95	340,345	.76	1.13	335,643	1.25	1.19	.92	1.11
Smackover	1,483,694	.76	1.05	721,858	1.17	.81	670,677	1.16	.82	562,861	1.35	.83	1.02	.92
Total	1,980,827	.78	1.08	1,060,919	1.08	.86	1,011,022	1.02	.92	898,504	1.31	.96	.99	.98
Louisiana:														
Bull Bayou, Red River, and Sabine Parishes	97,105	1.15	1.12											
Haynesville, Homer	435,753	1.77	1.43	403,761	1.82	1.18	370,697	1.33	1.30	332,675	1.47	1.27	1.15	1.12
De Soto, Mansfield, Caddo	262,655	1.28	1.39	158,473	1.62	1.32	270,556	1.26	1.47	324,077	1.47	1.30	1.61	1.30
Gulf coast	221,729	.71	1.14	202,000	.71	1.12	336,453	1.00	1.23	389,527	.86	1.06	1.39	1.37
Total	1,017,242	1.35	1.33	764,234	1.49	1.20	977,706	1.20	1.32	1,046,279	1.23	1.20	.84	1.14
Wyoming:													1.31	1.26
Salt Creek	1,730,934	1.17	1.39	1,532,193	1.09	1.30	1,287,788	1.05	1.33	1,355,270	.86	1.25	1.05	1.32
Grass Creek	135,125	1.91	1.56	132,234	2.03	1.36	119,095	.82	1.50				1.62	1.47
All others	197,808	.99	.84	211,002	1.36	.77	505,178	1.35	.89	400,833	1.35	.83	1.30	.84
Total	2,063,867	1.20	1.35	1,875,429	1.18	1.24	1,912,061	1.11	1.22	1,756,103	.97	1.15	1.12	1.25

2. Department of the Interior, Petroleum Administrative Board, *Preliminary Report on a Survey of Crude Petroleum, Cost of Production for the Years* 1931–1933 [pp. 5, 10–33]:

TABLE 1.—*Crude petroleum—Average cost per barrel (company interest oil) at wells and sales value by groups of States, 1931–33*

[Group A, California; group B, Texas, Oklahoma, Kansas, Arkansas, Louisiana, and New Mexico; group C, Colorado, Montana, and Wyoming; group D, Illinois, Indiana, Ohio, Michigan, Kentucky, West Virginia, Pennsylvania, and New York]

	1931					1932				
	Group A	Group B	Group C	Group D	Total all groups	Group A	Group B	Group C	Group D	Total all groups
Production	125, 536, 923	398, 774, 351	12, 421, 279	21, 564, 280	558, 296, 833	121, 941, 496	361, 733, 693	10, 453, 984	23, 457, 765	517, 586, 938
Expenses:										
Depletion	$0.063	$0.082	$0.237	$0.162	$0.084	$0.070	$0.076	$0.233	$0.160	$0.081
Depreciation	.190	.140	.221	.311	.160	.170	.135	.222	.281	.152
Amortization of intangible development costs	.023	.036	.051	.148	.037	.025	.041	.060	.148	.043
Operating cost	.233	.190	.340	.643	.220	.208	.189	.347	.556	.213
General overhead and administration	.207	.397	.215	.303	.347	.188	.293	.201	.236	.264
Total	.716	.845	1.064	1.567	.848	.661	.734	1.063	1.381	.753
Less gas sales and miscellaneous revenue	.165	.029	.049	.103	.063	.148	.027	.052	.084	.059
Net cost	.551	.816	1.015	1.464	.785	.513	.707	1.011	1.297	.694
Interest at 6 percent on investment	.138	.085	.179	.343	.109	.137	.093	.174	.296	.114
Net cost, including interest	.689	.901	1.[illegible]4	1.807	.894	.650	.800	1.185	1.593	.808
Average sales value at well	.705	.576	.878	1.396	.643	.799	.840	.972	1.387	.858

	Jan. 1 to Sept. 30, 1933					Oct. 1 to Dec. 31, 1933				
	Group A	Group B	Group C	Group D	Total all groups	Group A	Group B	Group C	Group D	Total all groups
Production	85, 936, 231	313, 090, 484	6, 569, 548	15, 995, 948	421, 592, 211	28, 039, 308	97, 296, 901	2, 716, 840	6, 098, 359	134, 151, 408
Expenses:										
Depletion	$0.072	$0.065	$0.235	$0.158	$0.073	$0.073	$0.067	$0.221	$0.155	$0.076
Depreciation	.158	.115	.235	.288	.132	.162	.123	.223	.260	.139
Amortization of intangible development costs	.030	.055	.062	.152	.054	.032	.055	.048	.200	.056
Operating cost	.193	.149	.334	.524	.175	.215	.198	.339	.559	.221
General overhead and administration	.161	.225	.170	.222	.211	.184	.260	.170	.228	.241
Total	.614	.609	1.036	1.344	.645	.666	.783	1.001	1.402	.733
Less gas sales and miscellaneous revenue	.150	.022	.036	.081	.051	.201	.037	.065	.077	.074
Net cost	.464	.587	1.000	1.263	.594	.465	.666	.936	1.325	.659
Interest at 6 percent on investment	.137	.086	.180	.293	.105	.150	.092	.147	.255	.113
Net cost, including interest	.601	.673	1.180	1.556	.699	.615	.758	1.083	1.580	.772
Average sales value at well	.792	.481	.770	1.239	.578	.924	.965	.918	1.770	.992

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
CALIFORNIA																
Long Beach (Signal Hill), Seal Beach, including Alamitos Heights, pools																
1931	19–32	27. 2–501. 0	16, 353, 684	$0. 043	$0. 271	$0. 037	$0. 263	$0. 226	$0. 840	$0. 169	$0. 671	$0. 113	$0. 784	$0. 756	$0. 18	$2. 54
1932	19–30	25. 0–585. 0	14, 666, 903	.039	.234	.048	.259	.212	.792	.144	.648	.108	.756	.839	.41	2. 69
First 9 months of 1933	19–32	15. 0–209. 7	9, 804, 611	.060	.175	.041	.259	.196	.731	.119	.612	.112	.724	.824	.30	3. 42
Last 3 months of 1933	19–32	15. 5–209. 7	2, 843, 224	.049	.195	.038	.326	.212	.820	.168	.652	.120	.772	.956	.28	2. 59
1933	19–32	14. 0–209. 7	12, 740, 041	.058	.180	.040	.275	.200	.753	.131	.622	.114	.736	.855	.28	3. 42
3-year weighted average	-------	----------	14, 586, 876	.046	.232	.042	.265	.214	.799	.150	.649	.111	.760	.812	-------	-------
Santa Fe Springs pool																
1931	32–35	44. 5–947. 8	12, 325, 632	.069	.345	.004	.242	.248	.908	.146	.762	.073	.835	.836	.29	2. 57
1932	32–35	38. 3–718. 5	11, 763, 354	.070	.275	.001	.227	.208	.781	.126	.655	.062	.717	.977	.32	3. 85
First 9 months of 1933	30–35	32. 9–488. 3	7, 446, 479	.059	.247	.003	.231	.157	.697	.106	.591	.054	.645	.980	.31	3. 05
Last 3 months of 1933	30–35	32. 9–488. 3	2, 058, 229	.058	.277	.004	.247	.191	.777	.142	.635	.090	.725	1. 174	.33	4. 99
1933	30–35	32. 9–488. 3	9, 637, 131	.058	.255	.003	.235	.164	.715	.115	.600	.063	.663	1. 021	.27	3. 05
3-year weighted average	-------	----------	11, 242, 039	.066	.295	.003	.235	.209	.808	.130	.678	.066	.744	.938	-------	-------
Torrance (Redondo) pool																
1931	15–20	5. 0– 60. 0	1, 306, 512	.060	.311	.001	.613	.202	1. 187	.044	1. 143	.350	1. 493	.668	.78	2. 58
1932	15–20	4. 6– 49. 1	1, 374, 296	.067	.321	.001	.483	.167	1. 039	.027	1. 012	.313	1. 325	.679	.59	3. 34
First 9 months of 1933	15–22	4. 2– 45. 8	1, 061, 492	.065	.264	.002	.429	.150	.910	.029	.881	.284	1. 165	.655	.52	3. 38
Last 3 months of 1933	15–20	4. 2– 45. 8	387, 354	.061	.278	.001	.446	.164	.950	.030	.920	.259	1. 179	.761	.40	3. 33
1933	15–22	4. 2– 45. 8	1, 459, 963	.063	.266	.002	.434	.156	.921	.029	.892	.276	1. 168	.681	.40	3. 38
3-year weighted average	-------	----------	1, 380, 257	.063	.299	.001	.507	.174	1. 044	.033	1. 011	.312	1. 323	.676	-------	-------

Huntington Beach and Newport pools																
1931	14–30	11.3–152.3	4,020,282	.078	.218	.007	.377	.196	.876	.076	.800	.157	.957	.724	.49	1.99
1932	14–30	14.5–149.9	4,103,484	.098	.179	.009	.264	.177	.727	.054	.673	.139	.812	.787	.52	2.68
First 9 months of 1933	14–26	12.0–190.0	3,308,670	.104	.116	.023	.218	.167	.628	.052	.576	.117	.693	.792	.11	2.82
Last 3 months of 1933	14–28	12.0–248.0	1,198,860	.091	.155	.030	.233	.173	.682	.069	.613	.113	.726	.920	.15	3.25
1933	14–28	12.0–248.0	4,520,764	.101	.127	.025	.222	.169	.644	.057	.587	.117	.704	.826	.11	3.25
3-year weighted average			4,214,843	.093	.173	.014	.285	.180	.745	.062	.683	.137	.820	.781		
Lawndale, Potrero, and Rosecrans pools																
1931	23–45	8.0–217.0	768,989	.191	.441	.022	.428	.126	1.208	.303	.905	.250	1.155	.951	.36	14.67
1932	23–45	8.5–83.3	573,813	.435	.291	.002	.355	.105	1.188	.338	.850	.203	1.053	1.006	.23	11.74
First 9 months of 1933	27–45	9.0–183.0	366,167	.111	.238	.004	.323	.100	.776	.398	.378	.179	.557	1.034	.10	19.98
Last 3 months of 1933	27–45	9.0–183.0	129,168	.108	.228	.007	.279	.060	.682	.422	.260	.226	.486	1.190	.10	2.95
1933	27–45	9.0–183.0	500,933	.110	.233	.005	.314	.090	.752	.400	.352	.189	.541	1.074	.10	19.98
3-year weighted average			614,578	.245	.337	.011	.375	.110	1.078	.340	.738	.219	.957	1.002		
Inglewood and Playa Del Rey pools																
1931	19–38	13.8–178.5	5,892,382	.056	.179	.036	.181	.200	.652	.041	.611	.060	.671	.646	.13	2.61
1932	17–38	12.9–231.0	4,785,568	.057	.169	.019	.185	.170	.600	.045	.555	.055	.610	.678	.23	1.83
First 9 months of 1933	14–23	6.0–132.4	2,867,689	.067	.168	.024	.167	.159	.585	.054	.531	.051	.582	.711	.25	1.81
Last 3 months of 1933	14–24	6.0–132.4	746,860	.067	.202	.021	.208	.185	.683	.049	.634	.061	.695	.870	.32	7.90
1933	14–24	6.0–132.4	3,779,803	.064	.173	.023	.177	.165	.602	.052	.550	.054	.604	.741	.25	7.90
3-year weighted average			4,819,251	.058	.174	.027	.182	.181	.622	.045	.577	.057	.634	.681		
Dominguez pool																
1931	27–31	57.2–270.4	2,290,110	.086	.195	.011	.142	.147	.581	.206	.375	.138	.513	.794	.37	.60
1932	27–31	83.8–268.8	3,738,433	.075	.124	.013	.091	.116	.419	.182	.237	.127	.364	.952	.20	.61
First 9 months of 1933	27–32	86.3–200.5	2,737,616	.062	.124	.007	.087	.114	.394	.198	.196	.193	.389	.938	.17	.58
Last 3 months of 1933	27–32	86.3–200.5	838,893	.071	.132	.017	.097	.094	.411	.277	.134	.210	.344	1.081	.13	.82
1933	27–32	86.3–200.5	3,576,509	.064	.126	.010	.089	.109	.398	.216	.182	.196	.378	.971	.13	.82
3-year weighted average			3,201,684	.073	.142	.011	.103	.121	.450	.201	.249	.156	.405	.921		
Brea-Olinda, Coyote Hills, Richfield, Montebello, Whittier, La Habra, Merced Hills and Baldwin Hills pools																
1931	16–31	1.0–153.4	9,666,300	.081	.175	.015	.295	.183	.749	.092	.657	.166	.823	.728	.49	6.29
1932	16–31	1.0–293.9	8,858,702	.077	.149	.021	.263	.165	.675	.084	.591	.175	.766	.771	.47	1.92
First 9 months of 1933	16–31	1.0–190.5	5,885,085	.102	.162	.021	.236	.150	.671	.071	.600	.134	.734	.790	.50	2.99
Last 3 months of 1933	16–31	1.0–190.5	2,293,603	.096	.150	.018	.229	.156	.649	.099	.550	.168	.718	.939	.42	2.00
1933	16–31	1.0–190.5	8,612,069	.097	.166	.019	.241	.164	.687	.078	.609	.147	.756	.828	.42	2.99
3-year weighted average			9,045,690	.085	.163	.018	.268	.171	.705	.085	.620	.163	.783	.774		

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses					Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
CALIFORNIA—Continued																
Other Los Angeles Basin[1]																
1931	15–35	8.4–99.5	5,498,541	$0.037	$0.225	$0.001	$0.208	$0.202	$0.673	$0.112	$0.561	$0.121	$0.682	$0.772	$0.67	$1.26
1932	16–35	21.2–91.0	5,320,721	.041	.213	.006	.193	.118	.571	.084	.487	.108	.595	.842	.55	.69
First 9 months of 1933	17–35	24.9–43.0	3,540,915	.047	.233	.022	.204	.120	.626	.092	.534	.103	.637	.830	.44	.66
Last 3 months of 1933	17–35	24.9–43.0	971,944	.046	.270	.012	.267	.162	.757	.117	.640	.125	.765	.976	.44	.78
1933	17–35	24.9–43.0	4,512,859	.047	.241	.020	.217	.129	.654	.097	.557	.108	.665	.861	.44	.78
3-year weighted average			5,110,707	.041	.225	.008	.206	.152	.632	.098	.534	.112	.646	.822		
Ventura Avenue pool																
1931	23–30	3.0–194.8	13,378,512	.033	.190	.028	.159	.177	.587	.255	.332	.089	.421	.753	.24	15.77
1932	23–30	3.4–336.5	10,823,708	.030	.246	.046	.156	.175	.653	.283	.370	.105	.475	.899	.35	1.61
First 9 months of 1933	13–30	3.1–264.6	8,238,355	.025	.237	.066	.130	.160	.618	.269	.349	.103	.452	.878	.34	5.97
Last 3 months of 1933	23–30	3.1–246.6	2,693,541	.032	.227	.093	.154	.130	.636	.346	.290	.105	.395	1.025	.19	6.07
1933	13–30	3.1–264.6	10,931,896	.027	.234	.073	.136	.152	.622	.288	.334	.104	.438	.915	.19	6.07
3-year weighted average			11,711,372	.030	.221	.048	.151	.169	.619	.274	.345	.098	.443	.848		
Bardsdale, Conejo, Newhall, Ojai, Piru, Santa Paula, Simi, and Serpe pools																
1931	13–36	1.2–64.0	116,846	.035	.220	.030	.373	.236	.894	.002	.892	.354	1.246	.635	.51	11.54
1932	13–35	1.7–52.3	166,054	.078	.179	.028	.326	.221	.832	.026	.806	.259	1.065	.647	.68	3.31
First 9 months of 1933	22–36	1.6–35.0	90,110	.116	.197	.054	.315	.147	.829	.024	.805	.363	1.168	.700	1.00	1.92
Last 3 months of 1933	22–36	1.6–35.0	28,320	.108	.248	.059	.339	.125	.879	.043	.836	.382	1.218	.728	1.00	1.36
1933	22–36	1.6–35.0	139,425	.097	.221	.047	.312	.144	.821	.024	.797	.315	1.112	.695	.73	1.92
3-year weighted average			140,775	.073	.204	.035	.334	.200	.846	.019	.827	.304	1.131	.659		

Santa Barbara beach fields [1]																
1931	22–36	14.0–1,044.5	8,009,688	.049	.138	.015	.145	.192	.539	.062	.477	.053	.530	.757	.35	1.61
1932	15–36	16.0– 577.0	4,310,847	.063	.182	.029	.192	.233	.699	.054	.645	.063	.728	.930	.54	15.99
First 9 months of 1933	27–36	17.0– 460.8	2,961,955	.077	.198	.054	.181	.179	.689	.041	.648	.076	.724	.916	.55	2.26
Last 3 months of 1933	23–36	17.0– 460.8	930,928	.038	.237	.065	.212	.253	.905	.048	.757	.081	.838	1.019	.19	2.83
1933	23–36	17.0– 460.8	3,892,883	.067	.207	.057	.188	.197	.716	.043	.673	.078	.751	.941	.19	2.83
3-year weighted average			5,404,473	.057	.166	.029	.168	.204	.624	.055	.569	.067	.636	.847		
Arroyo Grande, Casmalia, Cat Canyon, Lompoc, and Santa Maria pools																
1931	12–23	6.5– 17.0	670,135	.136	.313		.342	.128	.919	.103	.816	.474	1.290	.595	.64	1.49
1932	12–23	6.4– 68.7	776,458	.170	.117	.001	.308	.100	.696	.093	.603	.508	1.111	.599	.67	2.27
First 9 months of 1933	12–23	3.0– 71.8	599,769	.170	.173	.001	.242	.107	.693	.093	.600	.595	1.195	.613	.75	2.32
Last 3 months of 1933	12–23	3.0– 71.8	342,247	.154	.154		.177	.055	.540	.090	.450	.346	.796	.727	.67	2.09
1933	12–23	3.0– 71.8	942,016	.164	.166		.219	.088	.637	.092	.545	.505	1.050	.655	.67	2.32
3-year weighted average			796,203	.158	.192		.282	.103	.735	.095	.640	.497	1.137	.620		
Coalinga pool																
1931	14–23	2.7– 224.9	2,277,564	.113	.103	.001	.416	.170	.803	.040	.763	.541	1.304	.558	.19	185.61
1932	13–23	4.6– 60.6	2,945,786	.132	.093		.310	.145	.680	.020	.660	.394	1.054	.575	.19	2.08
First 9 months of 1933	14–23	4.3– 47.0	2,485,842	.130	.095		.232	.136	.593	.012	.581	.328	.909	.557	.16	1.52
Last 3 months of 1933	14–23	4.3– 47.0	1,274,830	.141	.070		.217	.160	.588	.009	.579	.213	.792	.700	.17	1.32
1933	14–23	4.3– 47.0	3,804,715	.133	.086		.228	.143	.590	.011	.579	.286	.865	.604	.16	1.35
3-year weighted average			3,009,355	.127	.092		.303	.151	.673	.021	.652	.386	1.038	.583		
Kern River, Mount Poso, Round Mountain, and Fruitvale pools																
1931	13–22	.8– 233.3	6,644,579	.053	.143	.006	.216	.349	.767	.007	.760	.166	.926	.533	.43	8.08
1932	13–22	2.1– 132.0	7,322,869	.060	.137	.020	.205	.276	.698	.009	.689	.144	.833	.533	.14	3.51
First 9 months of 1933	13–22	.4– 122.0	5,323,196	.056	.190	.021	.201	.202	.670	.006	.664	.133	.797	.518	.19	3.37
Last 3 months of 1933	13–22	.4– 122.0	1,686,053	.064	.139	.015	.185	.220	.623	.015	.608	.205	.813	.574	.31	68.81
1933	13–22	.4– 122.2	7,310,974	.060	.175	.019	.201	.201	.656	.008	.648	.152	.800	.530	.19	68.81
3-year weighted average			7,092,807	.058	.152	.015	.207	.273	.705	.008	.697	.154	.851	.532		

[1] Beverly Hills, Salt Lake, and Los Angeles pools.
[2] Includes Capitan, Elwood, Goleta, Santa Barbara, Rincon, and Summerland pools.

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
CALIFORNIA—Continued																
Elk Hills, McKittrick and Wheeler Ridge pools																
1931	14–23	12.0– 110.7	4,613,281	$0.065	$0.119	-------	$0.251	$0.197	$0.632	$0.031	$0.601	$0.159	$0.760	$0.593	$0.45	$1.65
1932	14–23	11.0– 70.4	4,191,404	.060	.084	-------	.214	.179	.537	.017	.520	.161	.681	.597	.43	1.04
First 9 months of 1933	14–23	9.2– 58.0	3,314,668	.063	.077	-------	.194	.174	.508	.008	.500	.146	.646	.573	.38	1.42
Last 3 months of 1933	14–23	7.3– 58.0	1,016,943	.069	.100	-------	.219	.200	.588	.019	.569	.165	.734	.658	.37	1.97
1933	14–23	7.3– 58.0	4,331,617	.064	.083	-------	.200	.180	.527	.011	.516	.150	.666	.593	.37	1.97
3-year weighted average	-------	-------	4,378,766	.063	.096	-------	.222	.186	.567	.020	.547	.157	.704	.594	-------	-------
Belridge and Lost Hills pools																
1931	14–40	1.1–1,863.2	2,729,300	.052	.048	$0.192	.126	.053	.471	.053	.418	.096	.514	.766	.17	3.96
1932	14–40	1.4–1,820.5	3,058,465	.049	.054	.175	.128	.051	.457	.083	.374	.081	.455	.868	.10	2.57
First 9 months of 1933	15–40	5.0– 284.7	2,075,438	.054	.069	.105	.164	.067	.459	.118	.341	.087	.428	.857	.27	2.53
Last 3 months of 1933	15–40	4.8– 284.7	804,473	.069	.072	.140	.280	.095	.656	.091	.565	.096	.661	.970	.29	4.89
1933	15–40	4.8– 284.7	2,879,911	.058	.070	.115	.196	.075	.514	.110	.404	.089	.493	.889	.27	4.89
3-year weighted average	-------	-------	2,889,225	.053	.057	.161	.150	.060	.481	.083	.398	.088	.486	.842	-------	-------
Midway-Sunset pool [1]																
1931	11–27	2.9– 392.0	15,474,198	.094	.146	.007	.317	.169	.733	.044	.689	.246	.935	.608	.27	3.64
1932	11–27	2.7– 356.0	14,745,997	.092	.139	.008	.278	.159	.676	.051	.625	.239	.864	.656	.27	3.57
First 9 months of 1933	11–27	2.7– 99.0	9,910,314	.091	.105	.007	.258	.139	.600	.063	.537	.237	.774	.669	.23	3.92
Last 3 months of 1933	11–27	2.7– 99.0	3,574,187	.087	.118	.006	.267	.199	.677	.070	.607	.219	.826	.756	.18	3.64
1933	11–27	2.7– 184.0	14,571,597	.091	.114	.006	.262	.149	.622	.063	.559	.231	.790	.694	.18	3.92
3-year weighted average	-------	-------	14,930,598	.092	.133	.007	.286	.160	.678	.052	.626	.239	.865	.652	-------	-------

Kettleman Hills pool																
1931	35–59	1,116.5–4,060.0	12,249,164	.058	.064	.048	.093	.237	.500	.669	−.169	.083	−.086	.649	−0	1.60
1932	35–59	904.0–2,435.0	17,379,916	.084	.075	.023	.082	.238	.502	.424	.078	.100	.178	.879	−0	6.50
First 9 months of 1933	37–58	545.0–1,586.2	13,289,899	.084	.087	.046	.079	.174	.470	.435	.035	.118	.153	.865	−0	1.48
Last 3 months of 1933	35–58	545.0–1,586.2	4,025,130	.088	.092	.038	.088	.230	.536	.676	−.140	.130	−.010	1.092	−0	1.69
1933	35–38	545.0–1,586.2	17,420,522	.085	.092	.044	.082	.187	.490	.488	.002	.121	.123	.918	−0	1.69
3-year weighted average			15,683,201	.078	.079	.037	.085	.219	.498	.512	−.014	.103	.089	.834		
Other and unclassified																
1931	16–30	4.2–389.0	1,251,224	.175	.254	.024	.358	.330	1.141	.038	1.103	.131	1.234	.600	.95	17.57
1932	16–30	19.9–901.0	1,034,718	.108	.226	.117	.365	.210	1.026	.042	.984	.136	1.120	.735	.80	3.35
First 9 months of 1933	21–30	18.0–449.5	627,961	.083	.240	.173	.351	.233	1.080	.028	1.052	.166	1.218	.763	.80	63.64
Last 3 months of 1933	16–30	18.0–449.5	194,521	.079	.258	.195	.372	.261	1.165	.036	1.129	.178	1.307	.913	.78	4.84
1933	16–30	18.0–449.5	1,017,160	.088	.227	.144	.334	.215	1.008	.040	.968	.156	1.124	.794	.64	63.64
3-year weighted average			1,101,034	.128	.237	.090	.353	.256	1.064	.040	1.024	.141	1.165	.702		
TOTAL CALIFORNIA																
1931			125,536,923	.063	.190	.023	.233	.207	.716	.165	.551	.138	.689	.705		
1932			121,941,496	.070	.170	.025	.208	.188	.661	.148	.513	.137	.650	.799		
First 9 months of 1933			85,936,231	.072	.158	.030	.193	.161	.614	.150	.464	.137	.601	.792		
Last 3 months of 1933			28,039,308	.073	.162	.032	.215	.184	.666	.201	.465	.150	.615	.924		
1933			116,582,782	.073	.160	.030	.201	.166	.630	.160	.470	.141	.611	.822		
3-year weighted average			121,353,734	.068	.173	.026	.215	.188	.670	.158	.512	.139	.651	.774		
TEXAS																
Panhandle [4]																
1931	31–44	3.3–112.7	13,121,898	.090	.254	.034	.231	.425	1.034	.122	.912	.134	1.046	.515	.18	4.88
1932	30–44	4.0–128.3	12,012,762	.091	.238	.038	.230	.306	.903	.099	.804	.135	.939	.779	.20	2.85
First 9 months of 1933	31–44	5.0–119.5	8,284,153	.116	.233	.050	.217	.243	.859	.087	.772	.128	.900	.436	−0	3.08
Last 3 months of 1933	31–44	5.0–150.4	2,511,474	.125	.243	.050	.257	.246	.921	.147	.774	.141	.915	.864	−0	3.77
1933	30–44	5.0–150.4	11,121,274	.117	.232	.049	.226	.250	.874	.104	.770	.132	.902	.536	−0	3.77
3-year weighted average			12,085,311	.098	.242	.040	.229	.332	.941	.109	.832	.134	.966	.609		
West Texas [5]																
1931	23–40	2.0–242.9	49,259,615	.040	.091	.010	.117	.379	.637	.009	.628	.045	.673	.438	.19	21.09
1932	23–40	1.0–251.6	39,989,292	.038	.088	.024	.128	.264	.542	.009	.533	.051	.584	.671	.24	10.68
First 9 months of 1933	23–40	2.6–156.6	25,970,560	.035	.087	.031	.114	.206	.473	.009	.464	.052	.516	.354	−0	10.94
Last 3 months of 1933	24–40	2.6–156.6	6,846,154	.046	.101	.032	.150	.293	.622	.029	.593	.065	.658	.773	.27	6.28
1933	23–40	2.6–156.6	33,084,922	.037	.090	.031	.121	.223	.502	.013	.489	.055	.544	.441	−0	10.94
3 year weighted average			40,777,943	.038	.090	.021	.122	.299	.570	.010	.560	.049	.609	.515		

[4] Includes Maricopa.
[4] Includes Hutchinson, Carson, Gray, Moore, and Wheeler Counties.
[5] Includes Howard, Ector, Mitchell, Irion, Pecos, Fisher, Loving, Winkler, Ward, Reeves, Glasscock, Crane, Upton, Midland, Reagan, and Crockett Counties.

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
TEXAS—Continued																
North Texas [6]																
1931	23–42	0.3– 71.0	12,743,213	$0.240	$0.237	$0.026	$0.391	$0.353	$1.247	$0.078	$1.169	$0.176	$1.345	$0.630	$0.20	$7.39
1932	23–42	.4– 65.6	11,541,129	.206	.229	.030	.340	.259	1.064	.068	.996	.161	1.157	.916	.15	3.57
First 9 months of 1933	23–42	.4– 87.6	7,665,816	.196	.212	.030	.332	.221	.991	.067	.924	.147	1.071	.513	.23	4.86
Last 3 months of 1933	23–47	.4–503.0	2,730,965	.179	.204	.038	.378	.232	1.031	.106	.925	.139	1.064	.984	.24	5.56
1933	23–47	.4–503.0	11,446,881	.185	.204	.031	.336	.217	.973	.073	.900	.143	1.043	.637	.22	5.56
3-year weighted average			11,910,408	.211	.224	.029	.357	.279	1.100	.073	1.027	.160	1.187	.725		
Central Texas [7]																
1931	28–42	.7– 39.6	2,722,394	.107	.128	.003	.382	.529	1.149	.095	1.054	.056	1.110	.589	.45	2.77
1932	28–42	.5– 42.8	1,667,534	.072	.140	.010	.317	.413	.952	.128	.824	.057	.881	.782	.21	5.30
First 9 months of 1933	28–42	.6– 34.1	1,084,955	.055	.132	.023	.298	.343	.851	.082	.769	.048	.817	.440	.41	2.13
Last 3 months of 1933	29–42	.6– 34.1	314,716	.057	.117	.019	.326	.439	.958	.162	.796	.055	.851	.906	.38	1.55
1933	28–42	.6– 34.1	1,399,671	.056	.128	.022	.304	.365	.875	.100	.775	.049	.824	.545	.38	2.13
3-year weighted average			1,929,866	.085	.131	.009	.345	.456	1.026	.106	.920	.055	.975	.634		
Caldwell, Bastrop, and Guadalupe Counties																
1931	27–38	2.4– 68.4	12,077,607	.071	.102	.002	.253	.349	.777	.004	.773	.051	.824	.567	.46	2.99
1932	27–38	4.7– 56.8	8,885,632	.066	.095	.004	.235	.249	.649	.003	.646	.055	.701	.688	.50	2.72
First 9 months of 1933	27–38	1.6– 72.9	5,298,695	.074	.084	.006	.234	.195	.593	.004	.589	.058	.647	.401	.44	1.92
Last 3 months of 1933	27–37	1.6– 72.9	1,515,062	.074	.096	.006	.271	.233	.680	.004	.676	.067	.743	.834	−0	4.10
1933	27–38	1.6– 72.9	7,096,488	.073	.085	.006	.244	.200	.608	.004	.604	.058	.662	.497	−0	4.10
3-year weighted average			9,353,242	.069	.096	.004	.245	.280	.694	.003	.691	.053	.744	.588		
Other Central Texas [8]																
1931	18–46	1.0–183.4	1,881,446	.269	.144	.002	.092	.226	.733	.021	.712	.052	.764	.786	.33	11.99
1932	18–46	.9–178.0	1,482,193	.184	.112	.033	.165	.260	.754	.033	.721	.065	.786	.911	.29	7.13
First 9 months of 1933	22–48	.6– 59.0	746,990	.147	.111	.028	.187	.217	.690	.045	.645	.077	.722	.539	.31	6.51
Last 3 months of 1933	22–49	.6– 59.0	181,286	.133	.120	.021	.239	.268	.781	.104	.677	.104	.781	.947	.01	2.57
1933	22–49	.6– 59.0	982,415	.151	.112	.025	.201	.232	.721	.054	.667	.081	.748	.613	.01	6.51
3-year weighted average			1,448,685	.213	.126	.018	.142	.239	.738	.033	.705	.063	.768	.789		

Southwest Texas [6]																
1931	18-46	1.2- 81.0	2,091,077	.087	.115	.037	.243	.171	.653	.032	.621	.093	.714	.626	.29	12.53
1932	18-49	1.0-113.3	2,372,270	.072	.089	.042	.249	.154	.606	.030	.576	.082	.658	.802	.35	5.36
First 9 months of 1933	18-49	.5- 60.0	2,346,775	.043	.079	.063	.162	.160	.507	.023	.484	.065	.549	.425	.28	5.06
Last 3 months of 1933	18-49	.5- 60.0	596,497	.033	.078	.060	.256	.187	.614	.029	.585	.080	.665	.794	.32	52.50
1933	18-49	.5- 60.0	3,025,786	.040	.081	.063	.178	.169	.531	.023	.508	.067	.575	.501	.28	52.50
3-year weighted average			2,496,378	.063	.093	.049	219	.165	.589	.028	.561	.079	.640	.631		
Government Wells Pool																
1931	18-23	12.2-820.6	663,078	.076	.097	.027	.146	.181	.527	.075	.452	.031	.483	.661	.22	1.11
1932	18-24	1.6-147.3	1,251,333	.050	.055	.042	.119	.180	.446	.030	.416	.028	.444	.789	.21	1.11
First 9 months of 1933	18-24	9.5- 34.0	903,143	.053	.058	.039	.123	.142	.415	.029	.386	.087	.473	.426	.19	2.67
Last 3 months of 1933	18-24	9.5- 34.0	287,480	.008	.048	.027	.175	.188	.446	.034	.412	.051	.463	.797	.23	1.30
1933	18-24	9.5- 34.0	1,303,092	.043	.057	.040	.135	.150	.425	.033	.392	.077	.469	.512	.19	2.67
3-year weighted average			1,072,501	.052	.065	.038	.131	.168	.454	.040	.414	.048	.462	.650		
Texas Gulf Coast [10]																
1931	17-62	1.0-504.0	32,776,222	.070	.123	.020	.204	.318	.735	.045	.690	.061	.751	.688	.37	23.17
1932	17-62	2.8-600.0	29,359,159	.068	.119	.033	.199	.272	.691	.075	.616	.077	.693	.815	.30	20.03
First 9 months of 1933	17-41	.8-412.3	28,607,853	.043	.095	.047	.156	.215	.556	.056	.500	.080	.580	.532	.17	6.25
Last 3 months of 1933	17-41	.8-620.0	8,868,921	.052	.116	.066	.198	.284	.716	.066	.650	.089	.739	1.023	.19	8.95
1933	17-41	.8-620.0	38,368,659	.045	.100	.051	.166	.229	.591	.057	.534	.081	.615	.655	.17	8.95
3-year weighted average			33,501,347	.060	.113	.035	.188	.271	.667	.058	.609	.073	.682	.713		
East Texas proper [11]																
1931	37-42	10.8-175.9	58,347,999	.030	.044	.032	.074	.344	.524	.020	.504	.041	.545	.478	.11	2.96
1932	37-42	9.0-245.4	66,709,650	.034	.071	.053	.107	.281	.546	.017	.529	.080	.609	.945	.07	3.77
First 9 months of 1933	35-42	17.5- 54.2	76,951,245	.031	.064	.059	.065	.211	.430	.009	.421	.075	.496	.474	.11	1.41
Last 3 months of 1933	36-42	17.5- 54.2	22,721,552	.036	.077	.056	.086	.245	.500	.019	.481	.085	.566	.997	.10	1.54
1933	35-42	10.0- 96.6	102,240,415	.033	.067	.059	.070	.215	.444	.012	.432	.078	.510	.592	.10	1.59
3-year weighted average			75,766,021	.032	.063	.050	.082	.267	.494	.015	.479	.069	.548	.666		
Other east Texas [12]																
1931	32-41	1.3-198.4	14,276,496	.001	.028	.032	.054	.479	.594	.007	.587	.016	.603	.571	.49	13.06
1932	33-41	1.7-140.8	14,501,059	.002	.026	.035	.050	.327	.440	.006	.434	.025	.459	.857	.39	.89
First 9 months of 1933	33-41	2.9-139.5	11,917,017	.001	.025	.035	.031	.248	.340	.009	.331	.023	.354	.455	.30	.93
Last 3 months of 1933	33-41	2.9-139.5	3,028,338	.001	.028	.037	.051	.300	.417	.023	.394	.030	.424	.956	.33	1.04
1933	33-41	2.9-139.5	14,962,645	.001	.026	.036	.035	.258	.356	.012	.344	.024	.368	.556	.30	1.04
3-year weighted average			14,580,067	.001	.027	.034	.046	.353	.461	.008	.453	.022	.475	.661		

[6] Includes Wilbarger, Wichita, Clay, Montague, Foard, Haskell, Jones, Taylor, Baylor, Archer, Jack, Throckmorton, Young, Shackelford, Stephens, Palo Pinto, Runnels, Callahan, Eastland, Erath, Coleman, Brown, and Comanche Counties.
[9] Includes Limestone, Freestone, and Navarro Counties.
[8] Includes Williamson, Milan, Bexar, Atascosa, and McLennan Counties.
[9] Includes Duval (excluding Government wells), Webb, Zapata, Jim Hogg, and Starr Counties.
[10] Includes Kleberg, Refugio, Jackson, Wharton, Matagorda, Fort Bend, Brazoria, Montgomery, Harris, Liberty, Chambers, Hardin, Orange, and Jefferson Counties.
[11] Includes Upshur, Cherokee, Gregg, Rusk, and Smith Counties.
[12] Includes Van Zandt, Nacogdoches, Shelby, Panola, Harrison, Marion, and San Augustine Counties.

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
TEXAS—Continued																
Other and unclassified																
1931	18–63	2.2–128.7	14,185,944	$0.071	$0.031	$0.057	$0.157	$0.371	$0.687	$0.006	$0.681	$0.182	$0.863	$0.454	$2.43	$202.96
1932	18–63	1.9–77.8	13,138,638	.090	.030	.028	.128	.206	.482	.004	.478	.190	.668	.679	.28	5.57
First 9 months of 1933	17–63	1.0–531.9	10,999,451	.096	.053	.046	.128	.195	.518	.005	.513	.263	.776	.384	.34	89.19
Last 3 months of 1933	17–63	1.0–531.9	2,919,619	.096	.066	.062	.177	.234	.635	.011	.624	.330	.954	.854	.32	13.18
1933	17–63	1.0–531.9	13,934,620	.096	.056	.049	.139	.203	.543	.007	.536	.277	.813	.482	.25	89.19
3-year weighted average			13,753,067	.085	.039	.045	.142	.262	.573	.005	.568	.216	.784	.535		
TOTAL TEXAS																
1931			214,146,989	.061	.096	.024	.152	.364	.697	.029	.668	.068	.736	.528		
1932			202,910,651	.058	.097	.036	.152	.272	.615	.031	.584	.083	.667	.822		
First 9 months of 1933			180,776,653	.048	.085	.047	.115	.213	.508	.023	.485	.085	.570	.456		
Last 3 months of 1933			52,522,064	.054	.099	.051	.149	.260	.613	.040	.573	.098	.671	.946		
1933			238,966,868	.050	.088	.048	.123	.222	.531	.027	.504	.088	.592	.568		
3-year weighted average			218,674,836	.056	.093	.037	.142	.283	.611	.029	.582	.080	.662	.633		
OKLAHOMA																
Nowata, Rogers, Craig, and Washington Counties																
1931	24–37	.1–6.5	1,798,099	.117	.157	.008	.344	.208	.834	.025	.809	.093	.902	.588	.13	4.88
1932	24–37	.1–5.9	2,157,355	.105	.151	.008	.357	.142	.763	.022	.741	.076	.817	.825	.15	3.25
First 9 months of 1933	29–37	.2–5.0	1,426,651	.112	.164	.010	.313	.145	.744	.019	.725	.073	.798	.460	.15	4.03
Last 3 months of 1933	28–37	.2–5.0	470,059	.106	.150	.010	.476	.166	.908	.039	.869	.076	.945	.923	−0	2.74
1933	24–37	.2–5.0	2,008,650	.106	.154	.009	.346	.146	.761	.023	.738	.072	.810	.576	−0	4.03
3-year weighted average			1,988,035	.109	.154	.008	.350	.163	.784	.023	.761	.079	.840	.670		

Tulsa and Creek Counties [13]																	
1931	25–44	.1– 74.4	4,945,965	.120	.242	.022	.331	.467	1.182	.067	1.115	.128	1.243	.639	.22	4.47
1932	25–43	.2– 48.0	4,457,325	.115	.233	.033	.330	.328	1.039	.045	.994	.118	1.112	.877	.03	44.47
First 9 months of 1933	25–43	.2– 42.2	2,946,740	.107	.215	.037	.313	.272	.944	.040	.904	.102	1.006	.500	.18	8.76
Last 3 months of 1933	25–43	.2–105.5	1,013,520	.095	.197	.032	.405	.295	1.024	.062	.962	.099	1.061	.994	—0	6.43
1933	25–43	.2–105.5	4,199,510	.103	.211	.036	.332	.267	.949	.044	.905	.099	1.004	.627	—0	8.76
3-year weighted average			4,534,267	.113	.230	.029	.331	.360	1.063	.053	1.010	.116	1.126	.713		
Wagoner, Muskogee, and McIntosh Counties																	
1931	28–42	.1– 18.4	141,617	.131	.157	.006	.467	.307	1.068	.061	1.007	.080	1.087	.635	.52	3.85
1932	34–42	.3– 45.0	132,715	.113	.268	.011	.494	.293	1.179	.027	1.152	.074	1.226	.885	.53	3.69
First 9 months of 1933	34–42	.3– 50.7	103,696	.063	.106	.005	.372	.260	.806	.037	.769	.067	.836	.529	.48	2.64
Last 3 months of 1933	34–42	.3– 50.7	29,729	.058	.084	.008	.492	.382	1.024	.036	.988	.061	1.049	1.035	.03	3.79
1933	34–42	.3– 50.7	135,095	.061	.100	.006	.403	.285	.855	.036	.819	.065	.884	.643	.03	3.79
3-year weighted average			136,476	.102	.174	.008	.455	.295	1.034	.042	.992	.073	1.065	.718		
Okmulgee, Okfuskee, and Hughes Counties																	
1931	25–42	.5– 51.0	1,850,178	.246	.262	.008	.423	.398	1.337	.038	1.299	.201	1.500	.652	.26	13.55
1932	28–42	.2– 56.9	1,918,656	.358	.261	.023	.355	.292	1.289	.030	1.259	.168	1.427	.899	.16	11.72
First 9 months of 1933	29–41	.6– 67.2	1,350,404	.245	.209	.033	.317	.251	1.055	.026	1.029	.138	1.167	.518	.21	7.10
Last 3 months of 1933	29–41	.6–231.4	429,185	.246	.185	.022	.413	.263	1.129	.041	1.088	.128	1.216	1.002	—0	6.25
1933	28–41	.4–231.4	1,870,322	.233	.212	.029	.348	.246	1.068	.031	1.037	.135	1.172	.633	—0	7.10
3-year weighted average			1,879,719	.280	.245	.020	.375	.311	1.231	.032	1.199	.167	1.366	.730		
Osage County [14]																	
1931	29–41	.4– 19.0	4,957,816	.299	.310	.039	.304	.415	1.367	.033	1.329	.209	1.538	.640	.48	7.83
1932	29–41	.3– 50.7	4,676,731	.248	.307	.035	.324	.292	1.206	.024	1.182	.176	1.358	.894	.02	10.24
First 9 months of 1933	29–41	.3–230.0	3,419,038	.220	.227	.043	.307	.244	1.041	.073	.968	.171	1.139	.513	—0	64.39
Last 3 months of 1933	29–41	.3–230.0	1,370,708	.181	.201	.034	.330	.234	.980	.070	.910	.142	1.052	1.013	—0	4.09
1933	29–41	.3–230.0	4,833,682	.208	.218	.040	.313	.240	1.019	.071	.948	.162	1.110	.655	—0	64.39
3-year weighted average			4,822,743	.253	.278	.038	.313	.317	1.199	.045	1.154	.183	1.337	.728		
Pawnee, Payne, and Lincoln Counties																	
1931	33–41	.7–355.0	2,191,390	.236	.310	.025	.341	.351	1.263	.032	1.231	.155	1.386	.685	.38	3.87
1932	32–42	.6–277.0	2,631,316	.209	.248	.029	.242	.272	1.000	.019	.981	.101	1.082	.936	.41	4.19
First 9 months of 1933	33–43	.6–110.0	1,615,047	.182	.208	.044	.270	.212	.916	.015	.901	.097	.998	.546	.27	3.17
Last 3 months of 1933	33–41	.6–110.0	573,550	.214	.189	.045	.275	.236	.959	.025	.934	.091	1.025	1.052	.37	4.63
1933	33–43	.6–110.0	2,188,597	.190	.203	.044	.271	.219	.927	.017	.910	.095	1.005	.679	.27	4.63
3-year weighted average			2,337,101	.212	.253	.032	.282	.280	1.059	.022	1.037	.116	1.153	.777		

[13] Excludes Cushing pool.
[14] Excludes Burbank pool.

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
OKLAHOMA—Continued																
Noble, Kay, Logan, Garfield, and Grant Counties																
1931	37–47	1.7– 121.5	5,882,545	$0.104	$0.305	$0.052	$0.319	$0.513	$1.293	$0.054	$1.239	$0.123	$01.362	$0.709	−0	$10.47
1932	37–47	1.3– 127.0	4,712,650	.112	.261	.024	.337	.409	1.143	.034	1.109	.112	1.221	.953	−0	7.10
First 9 months of 1933	37–47	1.3– 563.3	3,399,381	.105	.242	.036	.284	.332	.999	.034	.965	.103	1.068	.586	$0.26	3.39
Last 3 months of 1933	37–47	1.3– 563.3	1,410,927	.071	.171	.034	.314	.360	.950	.041	.909	.083	.992	1.081	.31	4.27
1933	37–47	1.3– 563.3	4,875,361	.094	.223	.035	.294	.336	.982	.035	.947	.100	1.047	.731	.26	4.27
3-year weighted average			5,156,852	.103	.266	.038	.317	.426	1.150	.042	1.108	.112	1.220	.790		
Burbank pool																
1931	36–39	1.5– 21.0	2,216,525	.306	.291	.001	.271	.487	1.356	.082	1.274	.288	1.562	.663	.42	2.88
1932	36–39	1.8– 29.9	2,126,753	.364	.279	.009	.274	.351	1.277	.038	1.239	.300	1.539	.906	.30	2.70
First 9 months of 1933	35–39	1.2– 22.6	1,488,086	.362	.260	.020	.275	.262	1.179	.038	1.141	.295	1.436	.525	.40	2.56
Last 3 months of 1933	36–39	1.2– 22.6	483,182	.314	.266	.022	.358	.319	1.279	.094	1.185	.303	1.488	1.015	.25	2.93
1933	35–39	1.2– 22.6	1,971,268	.350	.261	.021	.295	.276	1.203	.052	1.151	.297	1.448	.645	.25	2.93
3-year weighted average			2,104,849	.339	.278	.010	.280	.375	1.282	.058	1.224	.295	1.519	.739		
Cushing pool																
1931	34–42	1.9– 26.2	5,337,474	.251	.203	.036	.370	.467	1.327	.069	1.258	.142	1.400	.677	.43	4.23
1932	34–42	1.4– 20.8	4,960,874	.207	.169	.031	.351	.341	1.099	.042	1.057	.111	1.168	.937	.44	18.53
First 9 months of 1933	35–42	1.0– 24.3	3,640,299	.199	.149	.033	.333	.282	.996	.040	.956	.107	1.063	.551	.41	2.43
Last 3 months of 1933	35–42	1.0– 24.3	1,209,631	.193	.158	.032	.408	.270	1.061	.087	.974	.108	1.082	1.051	.41	2.63
1933	35–42	1.0– 24.3	4,863,071	.198	.151	.033	.352	.278	1.012	.052	.960	.107	1.067	.676	.41	2.63
3-year weighted average			5,053,806	.220	.175	.033	.358	.365	1.151	.055	1.096	.121	1.217	.762		
Oklahoma City pool																
1931	36–41	24.5–1,032.0	25,778,791	.079	.103	.107	.112	.411	.812	.020	.792	.142	.934	.648	.24	51.26
1932	36–42	11.6– 275.0	17,728,513	.074	.140	.132	.172	.304	.822	.019	.803	.222	1.025	.910	.31	14.34
First 9 months of 1933	34–42	15.6– 736.6	20,274,070	.073	.122	.127	.095	.189	.606	.014	.592	.107	.699	.558	.10	1.87
Last 3 months of 1933	36–42	15.6– 736.6	9,202,110	.079	.113	.123	.152	.182	.649	.034	.615	.105	.720	1.033	.23	2.86
1933	34–42	15.6– 736.6	38,476,180	.075	.120	.126	.108	.187	.616	.018	.598	.106	.704	.671	.10	2.86
3-year weighted average			27,027,828	.076	.119	.121	.123	.283	.722	.019	.703	.143	.846	.716		

Healdton and Hewitt pools																
1931	29–34	1.5– 15.0	5,160,545	.104	.109	.005	.197	.430	.845	.018	.827	.082	.909	.528	.19	2.23
1932	29–35	1.5– 14.0	4,816,588	.100	.107	.010	.187	.299	.703	.010	.693	.077	.770	.806	.29	1.87
First 9 months of 1933	29–35	1.0– 13.0	3,351,588	.099	.098	.005	.178	.237	.617	.012	.605	.073	.678	.432	.25	1.56
Last 3 months of 1933	29–35	1.0– 13.0	1,073,380	.086	.092	.006	.233	.279	.696	.027	.669	.076	.745	.910	.34	1.58
1933	29–35	1.0– 13.0	4,426,963	.096	.097	.005	.191	.248	.637	.016	.621	.074	.695	.548	.25	1.63
3-year weighted average			4,801,365	.100	.104	.007	.192	.330	.733	.014	.719	.078	.797	.627		
Seminole pools [15]																
1931	29–41	2.2– 776.0	49,293,145	.094	.193	.039	.187	.488	1.001	.029	.972	.084	1.056	.687	.23	35.17
1932	29–41	1.7– 471.0	42,477,314	.081	.185	.035	.172	.375	.848	.016	.832	.071	.903	.924	.32	9.18
First 9 months of 1933	29–41	1.5–1,383.8	27,874,333	.070	.164	.029	.166	.305	.734	.017	.717	.065	.782	.551	.27	11.68
Last 3 months of 1933	29–41	1.5–1,383.8	9,388,634	.069	.163	.039	.214	.320	.805	.035	.770	.073	.843	1.047	.33	13.70
1933	29–41	1.5–1,383.8	37,612,987	.069	.165	.031	.178	.307	.750	.021	.729	.067	.796	.676	.27	24.60
3-year weighted average			43,127,815	.082	.182	.035	.179	.399	.877	.022	.855	.075	.930	.762		
Other pools in Stephens, Cotton, Murray, Carter, Pontotoc, Garvin, Grady, Caddo, Marshall, Comanche, and Jefferson Counties																
1931	18–42	.5– 86.7	7,556,597	.088	.186	.014	.243	.317	.848	.028	.820	.072	.892	.514	.16	33.55
1932	18–42	.3– 69.0	6,835,285	.085	.178	.022	.226	.265	.776	.016	.760	.064	.824	.767	.16	8.69
First 9 months of 1933	18–42	.6– 54.5	4,459,596	.080	.172	.019	.223	.214	.708	.015	.693	.061	.754	.423	.28	15.14
Last 3 months of 1933	18–42	.4– 54.5	1,532,041	.075	.153	.021	.276	.275	.800	.022	.778	.059	.837	.873	.34	5.02
1933	18–42	.4– 145.4	6,213,809	.078	.164	.019	.235	.223	.719	.017	.702	.060	.762	.536	.21	15.14
3-year weighted average			6,868,563	.084	.177	.018	.235	.271	.785	.021	.764	.066	.830	.605		
Other [16] *and unclassified*																
1931	33–40	.6– 16.3	4,837,539	.168	.411	.105	.348	.434	1.466	.046	1.420	.164	1.584	.637	.30	15.06
1932	33–40	.5– 10.2	3,342,968	.169	.348	.154	.354	.318	1.343	.040	1.303	.171	1.474	.885	.49	2.98
First 9 months of 1933	34–40	.3– 10.1	2,182,284	.174	.353	.212	.307	.265	1.311	.069	1.242	.160	1.402	.520	.44	2.60
Last 3 months of 1933	34–40	.3– 18.1	727,955	.182	.339	.110	.383	.323	1.337	.050	1.287	.161	1.448	1.017	.35	2.56
1933	34–40	.3– 18.1	2,910,239	.176	.349	.187	.326	.279	1.317	.064	1.253	.161	1.414	.644	.35	2.60
3-year weighted average			3,696,915	.170	.376	.141	.344	.359	1.390	.049	1.341	.165	1.506	.714		
TOTAL OKLAHOMA																
1931			121,948,226	.120	.196	.050	.216	.445	1.027	.033	.994	.117	1.111	.653		
1932			102,975,043	.115	.193	.051	.224	.335	.918	.022	.896	.118	1.014	.901		
First 9 months of 1933			86,531,213	.100	.162	.066	.180	.248	.756	.022	.734	.096	.830	.537		
Last 3 months of 1933			28,914,611	.098	.154	.063	.239	.262	.816	.040	.776	.096	.872	1.023		
1933			116,585,734	.099	.160	.065	.195	.250	.769	.026	.743	.096	.839	.658		
3-year weighted average			113,836,334	.111	.183	.058	.212	.345	.909	.027	.882	.110	.992	.729		

[15] Includes Pottawatomie and Seminole Counties.

[16] Includes Kiowa, Beckham, and Cimarron pools.

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
KANSAS																
Butler and Harvey Counties																
1931	30–40	0.7– 75.0	5,374,530	$0.086	$0.277	$0.041	$0.338	$0.406	$1.148	$0.010	$1.138	$0.090	$1.228	$0.625	$0.23	$21.08
1932	28–41	.7–349.0	4,754,788	.074	.312	.039	.328	.300	1.053	.010	1.043	.091	1.134	.871	.02	15.64
First 9 months of 1933	33–42	1.0–292.0	4,195,537	.065	.262	.054	.270	.201	.852	.008	.844	.061	.905	.525	.24	9.13
Last 3 months of 1933	33–42	1.0–292.0	1,456,202	.061	.264	.056	.355	.199	.935	.008	.927	.058	.985	.994	.26	11.49
1933	33–42	1.0–292.0	5,656,809	.064	.263	.054	.292	.201	.874	.009	.865	.060	.925	.646	.24	11.49
3-year weighted average			5,262,042	.074	.282	.045	.319	.301	1.021	.009	1.012	.079	1.091	.707		
Greenwood and Woodson Counties																
1931	29–41	.9– 25.0	2,065,779	.147	.282	.013	.258	.385	1.085	.020	1.065	.146	1.211	.713	.27	6.54
1932	29–41	.5– 15.0	1,803,042	.147	.249	.022	.276	.299	.993	.011	.982	.143	1.125	.934	.31	2.75
First 9 months of 1933	29–41	.5– 36.4	1,190,266	.166	.268	.040	.272	.260	1.006	.044	.962	.131	1.093	.561	.32	2.94
Last 3 months of 1933	29–41	.5– 36.4	434,410	.134	.262	.032	.331	.269	1.028	.042	.986	.122	1.108	1.026	.61	3.77
1933	29–41	.5– 36.4	1,650,620	.157	.264	.038	.288	.259	1.006	.043	.963	.128	1.091	.685	.61	3.77
3-year weighted average			1,839,814	.150	.266	.023	.273	.319	1.031	.024	1.007	.140	1.147	.777		
East Kansas [17]																
1931	18–37	.2– 58.0	2,315,433	.169	.262	.050	.322	.423	1.226	.024	1.202	.156	1.358	.625	.35	4.01
1932	18–37	.3– 41.8	1,959,693	.168	.281	.021	.339	.281	1.090	.022	1.068	.114	1.182	.862	.01	1.85
First 9 months of 1933	18–37	.1– 26.8	1,595,012	.130	.232	.042	.261	.244	.909	.020	.889	.123	1.012	.520	.40	2.22
Last 3 months of 1933	18–42	.1–125.0	609,108	.106	.192	.038	.300	.249	.885	.025	.860	.108	.968	1.002	.42	2.09
1933	18–42	.1–125.0	2,270,629	.119	.217	.040	.271	.240	.887	.021	.866	.116	.982	.652	.36	2.22
3-year weighted average			2,181,918	.152	.252	.038	.309	.317	1.068	.023	1.045	.129	1.174	.705		

Sedgwick County																
1931	38-42	8. 9-304. 5	3, 502, 495	.046	.138	.044	.230	.551	1. 009	.026	.983	.065	1. 048	.709	.29	4. 45
1932	38-42	7. 9-147. 5	2, 731, 009	.060	.132	.070	.248	.408	.918	.029	.889	.074	.963	.978	.36	1. 78
First 9 months of 1933	38-42	6. 1-122. 0	2, 000, 483	.044	.127	.058	.227	.347	.803	.025	.778	.068	.846	.562	.38	1. 91
Last 3 months of 1933	36-42	6. 1-122. 0	483, 467	.051	.123	.061	.278	.336	.849	.047	.802	.095	.897	1. 074	.42	1. 88
1933	36-42	6. 1-122. 0	2, 483, 950	.045	.126	.059	.237	.345	.812	.029	.783	.073	.856	.662	.38	1. 91
3-year weighted average			2, 905, 818	.050	.133	.056	.238	.447	.924	.027	.897	.070	.967	.780		
Sumner and Cowley Counties																
1931	34-41	2. 6-126. 0	2, 611, 415	.113	.296	.011	.222	.642	1. 284	.018	1. 266	.115	1. 381	.664	.35	10. 92
1932	34-42	2. 1- 70. 2	2, 637, 776	.096	.249	.033	.201	.324	.903	.010	.893	.098	.991	.922	.31	7. 27
First 9 months of 1933	34-41	3. 0- 68. 0	1, 654, 470	.178	.217	.216	.200	.253	1. 064	.008	1. 056	.101	1. 157	.542	.32	6. 66
Last 3 months of 1933	34-41	3. 0- 68. 0	435, 556	.097	.287	.030	.307	.286	1. 007	.025	.982	.124	1. 106	1. 060	.45	5. 05
1933	34-41	3. 0- 68. 0	2, 090, 026	.161	.232	.177	.222	.260	1. 052	.012	1. 040	.106	1. 146	.650	.32	6. 66
3-year weighted average			2, 446, 406	.120	.261	.066	.215	.419	1. 081	.013	1. 068	.106	1. 174	.753		
Rice, Reno, Ellsworth, Kingman, Rush, Barton, Russell, Trego, Ellis, and Rooks Counties																
1931	22-43	4. 5-134. 0	1, 525, 052	.084	.174	.069	.171	.391	.889	.022	.867	.096	.963	.649	.53	5. 21
1932	22-48	.8-580. 7	2, 074, 635	.078	.140	.076	.161	.261	.716	.014	.702	.090	.792	.904	.19	30. 32
First 9 months of 1933	28-47	1. 0-291. 8	1, 849, 630	.072	.132	.083	.158	.194	.639	.016	.623	.076	.699	.550	.30	28. 43
Last 3 months of 1933	28-47	1. 0-291. 8	815, 310	.074	.116	.059	.209	.233	.691	.015	.676	.058	.734	1. 040	.33	16. 98
1933	28-47	1. 0-291. 8	2, 664, 940	.073	.127	.075	.174	.206	.655	.016	.629	.070	.709	.700	.30	28. 43
3-year weighted average			2, 088, 209	.077	.143	.074	.169	.269	.732	.017	.715	.083	.798	.755		
McPherson County																
1931	33-42	2. 9-385. 0	3, 432, 647	.033	.120	.046	.145	.506	.850	.026	.824	.048	.872	.685	.24	11. 59
1932	33-42	5. 5-145. 0	3, 603, 946	.044	.126	.066	.152	.275	.663	.031	.632	.073	.705	.926	.24	2. 43
First 9 months of 1933	33-42	4. 2-319. 0	4, 092, 969	.071	.103	.124	.123	.223	.644	.012	.632	.056	.688	.556	.23	3. 17
Last 3 months of 1933	33-42	4. 2-319. 0	1, 169, 487	.052	.126	.099	.216	.290	.783	.019	.764	.066	.830	1. 038	.24	4. 85
1933	33-42	4. 2-319. 0	5, 342, 004	.069	.107	.121	.143	.234	.674	.013	.661	.057	.718	.664	.23	4. 85
3-year weighted average			4, 126, 199	.052	.116	.084	.146	.321	.719	.022	.697	.060	.757	.746		
Other and unclassified																
1931	34-40	1. 6- 15. 3	4, 493, 622	.074	.279	.113	.219	.385	1. 070	.014	1. 056	.131	1. 187	.685	.54	36. 13
1932	34-40	1. 7- 76. 7	2, 853, 664	.087	.301	.142	.285	.288	1. 103	.022	1. 081	.172	1. 253	.931	.34	7. 33
First 9 months of 1933	31-40	3. 6-201. 8	2, 469, 763	.079	.306	.131	.231	.210	.957	.030	.927	.133	1. 060	.549	.25	5. 82
Last 3 months of 1933	35-40	3. 6-201. 8	870, 585	.077	.309	.133	.275	.233	1. 027	.036	.991	.126	1. 117	1. 047	−0	2. 39
1933	31-40	3. 6-201. 8	3, 340, 348	.078	.307	.131	.243	.216	.975	.031	.944	.131	1. 075	.679	−0	5. 82
3-year weighted average			3, 562, 545	.079	.294	.126	.244	.306	1. 049	.021	1. 028	.142	1. 170	.749		

[17] Includes Douglas, Franklin, Miami, Anderson, Linn, Chase, Chautauqua, Elk, Allen, Bourbon, Neosho, LaBette, Crawford, Wilson, Marion, and Montgomery Counties.

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
KANSAS—Continued																
TOTAL KANSAS																
1931			25,320,973	$0.086	$0.232	$0.052	$0.246	$0.459	$1.075	$0.019	$1.056	$0.102	$1.158	$0.668		
1932			22,418,553	.086	.228	.060	.251	.305	.930	.019	.911	.104	1.015	.914		
First 9 months of 1933			19,048,130	.088	.201	.095	.211	.233	.828	.017	.811	.084	.895	.545		
Last 3 months of 1933			6,274,125	.074	.209	.070	.283	.252	.888	.023	.865	.085	.950	1.029		
1933			25,499,326	.085	.202	.089	.229	.236	.841	.019	.822	.084	.906	.665		
3-year weighted average			24,412,951	.086	.220	.067	.241	.335	.949	.019	.930	.096	1.026	.742		
ARKANSAS																
El Dorado pool																
1931	27–33	2.0– 15.6	538,067	.241	.250		.490	.300	1.281	.116	1.165	.084	1.249	.554	$0.38	$05.03
1932	27–34	1.7– 15.7	474,893	.131	.178	.002	.529	.206	1.046	.082	.964	.068	1.032	.774	.31	4.48
First 9 months of 1933	27–34	1.7– 15.2	305,884	.040	.154		.506	.168	.868	.088	.780	.057	.837	.414	.45	1.10
Last 3 months of 1933	20–34	1.7– 15.2	119,237	.039	.148	.002	.661	.186	1.036	.155	.881	.071	.952	.859	.32	1.17
1933	20–34	1.7– 15.7	425,121	.040	.152	.001	.549	.173	.915	.107	.808	.061	.869	.539	.32	1.17
3-year weighted average			496,027	.148	.199	.001	.519	.234	1.101	.102	.999	.072	1.071	.620		
Smackover pool																
1931	19–27	1.9– 20.8	6,209,927	.061	.193	.003	.387	.348	.992	.016	.976	.063	1.039	.488	.63	2.07
1932	19–27	3.2– 17.8	4,985,347	.056	.171	.010	.406	.227	.870	.008	.862	.060	.922	.618	.45	1.87
First 9 months of 1933	19–33	3.5– 15.8	3,847,099	.066	.183	.016	.416	.166	.847	.022	.825	.053	.878	.307	.50	2.87
Last 3 months of 1933	20–38	3.5– 15.8	1,070,656	.080	.165	.017	.511	.184	.957	.012	.945	.052	.997	.709	.62	2.66
1933	19–38	1.9– 20.8	4,917,755	.069	.179	.016	.437	.170	.871	.020	.851	.052	.903	.394	.50	2.87
3-year weighted average			5,371,010	.062	.182	.009	.408	.256	.917	.015	.902	.059	.961	.500		
Other pools																
1931	13–35	1.0– 25.0	2,990,185	.111	.287	.023	.438	.379	1.238	.027	1.211	.095	1.306	.483	.57	9.81
1932	13–36	1.5– 38.9	2,520,907	.129	.273	.026	.434	.245	1.107	.027	1.080	.079	1.159	.614	.29	3.72
First 9 months of 1933	17–36	1.4– 23.0	1,171,747	.052	.152	.011	.355	.235	.805	.016	.789	.059	.848	.375	.36	2.49
Last 3 months of 1933	17–36	1.4– 23.0	496,915	.080	.185	.024	.545	.221	1.055	.024	1.031	.066	1.097	.715	.48	2.41
1933	13–36	1.0– 38.9	1,720,436	.060	.157	.015	.407	.226	.865	.018	.847	.061	.908	.478	.36	2.49
3-year weighted average			2,410,509	.106	.251	.022	.429	.296	1.104	.025	1.079	.081	1.160	.528		

TOTAL ARKANSAS																	
1931			9,788,179	.088	.225	.009	.408	.355	1.085	.026	1.059	.074	1.133	.491			
1932			7,981,147	.084	.204	.014	.422	.231	.955	.018	.937	.067	1.004	.626			
First 9 months of 1933			5,324,730	.061	.175	.014	.408	.181	.839	.025	.814	.055	.869	.328			
Last 3 months of 1933			1,686,808	.077	.170	.019	.531	.195	.992	.026	.966	.057	1.023	.722			
1933			7,063,312	.065	.172	.015	.437	.184	.873	.025	.848	.055	.903	.424			
3-year weighted average			8,277,546	.080	.203	.012	.421	.267	.983	.023	.960	.066	1.026	.515			
LOUISIANA																	
Red River, De Soto, Elm Grove, Pleasant Hill, Zwolle, and Urania pools																	
1931	18–42	5.7– 149.5	3,430,431	.274	.135	.010	.377	.267	1.063	.018	1.045	.100	1.145	.643	.28	5.92	
1932	18–42	6.9– 138.3	2,491,271	.169	.153	.016	.423	.242	1.003	.016	.987	.114	1.101	.801	.23	14.94	
First 9 months of 1933	21–42	2.6– 277.5	1,875,750	.131	.119	.022	.368	.164	.804	.011	.793	.096	.889	.464	.20	3.11	
Last 3 months of 1933	21–42	2.6– 277.5	611,750	.063	.139	.026	.480	.198	.906	.013	.893	.097	.990	.887	.36	4.18	
1933	21–42	2.6– 277.5	2,579,205	.112	.121	.026	.393	.170	.822	.012	.810	.096	.906	.572	.20	4.18	
3-year weighted average			2,833,636	.194	.136	.016	.396	.230	.972	.015	.957	.103	1.060	.668			
Haynesville, Homer, Cotton Valley, Sarepta, and Carterville pools																	
1931	20–43	1.6– 49.1	2,854,527	.148	.262	.034	.486	.368	1.298	.053	1.245	.093	1.338	.642	.28	8.46	
1932	20–43	2.0– 36.8	2,227,892	.109	.173	.022	.407	.281	.992	.033	.959	.083	1.042	.856	.38	14.43	
First 9 months of 1933	20–43	1.9– 17.0	1,357,504	.074	.135	.025	.417	.215	.866	.028	.838	.074	.912	.444	.43	5.27	
Last 3 months of 1933	20–43	1.9– 17.0	435,741	.053	.126	.021	.484	.222	.906	.051	.855	.076	.931	.915	.45	5.51	
1933	20–43	1.9– 19.0	1,887,380	.069	.153	.023	.427	.211	.863	.032	.831	.075	.906	.559	.30	5.51	
3-year weighted average			2,323,266	.114	.199	.027	.445	.298	1.083	.041	1.042	.085	1.127	.688			
Caddo pool																	
1931	24–41	3.1– 145.7	1,278,443	.057	.183	-------	.577	.318	1.135	.057	1.078	.073	1.151	.639	.76	4.76	
1932	24–41	2.6– 140.7	1,017,588	.047	.158	-------	.601	.230	1.036	.065	.971	.072	1.044	.863	.75	1.62	
First 9 months of 1933	27–41	2.6– 102.6	687,658	.028	.145	-------	.625	.206	1.004	.074	.930	.066	.996	.449	.70	1.28	
Last 3 months of 1933	27–41	2.9– 102.6	224,132	.018	.126	-------	.787	.223	1.154	.086	1.068	.066	1.134	.920	.81	1.88	
1933	27–41	2.6– 102.6	911,790	.025	.141	-------	.665	.210	1.041	.077	.964	.066	1.030	.565	.70	1.88	
3-year weighted average			1,069,274	.044	.163	-------	.610	.260	1.077	.065	1.012	.070	1.082	.689			
Louisiana Gulf coast [18]																	
1931	17–39	3.1– 557.5	7,815,570	.060	.163	.027	.289	.342	.881	.016	.865	.070	.935	.653	.16	30.73	
1932	17–41	2.0– 527.4	9,840,301	.030	.118	.037	.241	.250	.676	.037	.639	.057	.696	.835	.39	37.21	
First 9 months of 1933	17–41	.4–1,183.5	9,315,814	.035	.085	.058	.201	.226	.605	.023	.582	.052	.634	.540	.32	10.18	
Last 3 months of 1933	17–41	.4–1,183.5	3,590,762	.043	.108	.050	.245	.251	.697	.015	.682	.045	.727	.988	.27	4.99	
1933	17–41	.4–1,183.5	13,015,610	.037	.091	.056	.215	.231	.630	.020	.610	.049	.659	.665	.27	10.18	
3-year weighted average			10,223,827	.041	.118	.0	42.242	.266	.709	.025	.684	.057	.741	.716			

[18] Includes Black Bayou, Choctaw, Edgerly, Hackberry, Jennings, Lake Barre, Leesville, Lockport, Port Barre, Sorrento, Starks, Sulphur, Sweetlake, Vinton, White Castle, Cameron Meadows, Gueydan, Iowa, Lake Washington, Lake Pelto, and Caillow Island pools.

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
LOUISIANA—Continued																
TOTAL LOUISIANA																
1931			15,378,971	$0.124	$0.177	$0.022	$0.369	$0.328	$1.020	$0.027	$0.993	$0.082	$1.075	$0.648		
1932			15,577,052	.065	.134	.029	.317	.252	.797	.035	.762	.071	.833	.834		
First 9 months of 1933			13,236,726	.052	.098	.047	.269	.215	.681	.025	.656	.061	.717	.515		
Last 3 months of 1933			4,862,385	.045	.114	.042	.321	.241	.763	.021	.742	.056	.798	.965		
1933			18,393,985	.050	.102	.045	.284	.220	.701	.023	.678	.060	.738	.636		
3-year weighted average			16,450,003	.077	.136	.033	.321	.264	.831	.028	.803	.070	.873	.702		
NEW MEXICO																
Hobbs pool																
1931	33–36	104.6–365.3	9,023,097	.012	.053	.015	.039	.521	.640	.014	.626	.034	.660	.410	$0.47	$1.28
1932	32–36	36.3–176.6	7,480,761	.007	.065	.023	.042	.381	.518	.015	.503	.040	.543	.605	.24	1.17
First 9 months of 1933	32–36	64.1–256.8	6,169,542	.007	.061	.041	.067	.290	.466	.014	.452	.039	.491	.337	.36	1.06
Last 3 months of 1933	32–36	64.1–256.8	2,298,818	.011	.057	.058	.084	.330	.520	.026	.494	.035	.529	.750	.40	1.57
1933	32–36	64.1–256.8	8,468,360	.008	.060	.040	.072	.300	.480	.017	.463	.038	.501	.449	.36	1.57
3-year weighted average			8,324,073	.009	.059	.026	.051	.404	.549	.015	.534	.037	.571	.481		
Other pools in Eddy and Lea Counties																
1931	26–60	1.3–564.0	1,375,209	.027	.110	.026	.102	.445	.710	.046	.664	.056	.720	.412	.28	9.15
1932	26–60	1.1–418.2	1,192,104	.034	.093	.033	.106	.296	.562	.025	.537	.063	.600	.616	.34	3.73
First 9 months of 1933	26–60	1.2–221.6	1,069,336	.034	.085	.044	.123	.254	.540	.034	.506	.055	.561	.331	.35	3.06
Last 3 months of 1933	26–60	1.2–221.6	399,738	.031	.083	.056	.190	.239	.599	.044	.555	.049	.604	.745	.35	2.81
1933	26–60	1.2–221.6	1,469,074	.033	.084	.047	.142	.250	.556	.037	.519	.053	.572	.443	.35	3.06
3-year weighted average			1,345,462	.031	.096	.036	.117	.330	.610	.037	.573	.057	.630	.484		

San Juan and McKinley Counties																
1931	31–61	35. 0–348. 5	1, 792, 707	.086	.103	.061	.074	.462	.786	.014	.772	.144	.916	.479	.40	2. 75
1932	31–61	24. 4–100. 5	1, 198, 382	.099	.119	.102	.094	.308	.722	.014	.708	.199	.907	.654	.19	3. 34
First 9 months of 1933	31–61	4. 6–248. 5	934, 154	.094	.105	.096	.099	.264	.658	.012	.646	.179	.825	.384	.50	3. 13
Last 3 months of 1933	31–61	4. 6–248. 5	338, 352	.102	.105	.095	.105	.310	.726	.017	.709	.164	.873	.805	.50	2. 88
1933	31–61	4. 6–248. 5	1, 272, 506	.096	.105	.096	.101	.279	.677	.014	.663	.175	.838	.496	.50	3. 13
3-year weighted average			1, 421, 198	.093	.108	.083	.088	.363	.735	.014	.721	.169	.890	.533		
TOTAL NEW MEXICO																
1931			12, 191, 013	.025	.067	.023	.051	.504	.670	.018	.652	.052	.704	.420		
1932			9, 871, 247	.021	.075	.034	.056	.362	.548	.016	.532	.062	.594	.612		
First 9 months of 1933			8, 173, 032	.021	.069	.048	.078	.282	.498	.017	.481	.057	.538	.341		
Last 3 months of 1933			3, 036, 908	.024	.065	.047	.100	.317	.553	.027	.526	.051	.577	.755		
1933			11, 209, 940	.022	.068	.047	.084	.292	.513	.019	.494	.055	.549	.453		
3-year weighted average			11, 090, 733	.023	.070	.034	.064	.390	.581	.018	.563	.056	.619	.488		
TEXAS, OKLAHOMA, KANSAS, ARKANSAS, LOUISIANA, AND NEW MEXICO COMBINED																
1931			398, 774, 351	.082	.140	.036	.190	.397	.845	.029	.816	.085	.901	.576		
1932			361, 733, 693	.076	.135	.041	.189	.293	.734	.027	.707	.093	.800	.840		
First 9 months of 1933			313, 090, 484	.065	.115	.055	.149	.225	.609	.022	.587	.086	.673	.481		
Last 3 months of 1933			97, 296, 901	.067	.123	.055	.198	.260	.703	.037	.666	.092	.758	.965		
1933			417, 719, 165	.065	.117	.055	.161	.231	.629	.026	.603	.087	.690	.596		
3-year weighted average			392, 742, 403	.074	.130	.044	.179	.307	.734	.027	.707	.088	.795	.664		
WYOMING																
Salt Creek pool																
1931	30–37	1. 9– 61. 0	6, 252, 600	.374	.233	.078	.296	.144	1. 125	.062	1. 063	.210	1. 273	1. 047	.32	5. 22
1932	30–37	.8– 63. 0	5, 361, 952	.359	.197	.078	.282	.131	1. 047	.066	.981	.193	1. 174	1. 134	.23	1. 96
First 9 months of 1933	30–37	1. 5– 64. 0	3, 554, 815	.357	.178	.078	.277	.134	1. 024	.039	.985	.178	1. 163	.955	.26	2. 40
Last 3 months of 1933	30–37	1. 5– 64. 0	1, 682, 890	.287	.177	.055	.274	.134	.927	.074	.853	.131	.984	.903	.22	2. 31
1933	30–37	1. 5– 64. 0	5, 351, 297	.331	.179	.069	.275	.133	.987	.050	.937	.165	1. 102	.931	.22	2. 40
3-year weighted average			5, 655, 283	.356	.204	.074	.285	.137	1. 056	.059	.997	.190	1. 187	1. 038		
Lost Soldier pool																
1931	29–29	53. 7– 77. 7	1, 222, 797	.033	.086	.001	.106	.178	.404	.010	.394	.051	.445	.564	.29	.45
1932	29–29	14. 6– 49. 6	755, 543	.032	.274	.001	.133	.348	.788	.030	.758	.033	.791	.800	.27	.81
First 9 months of 1933	29–29	24. 7– 35. 0	394, 286	.033	.590	.002	.141	.273	1. 039	.010	1. 029	.072	1. 101	.382	.28	1. 13
Last 3 months of 1933	29–29	24. 7– 35. 0	130, 886	.030	.546	.003	.162	.268	1. 009	.016	.993	.072	1. 065	.864	.35	1. 09
1933	29–29	24. 7– 35. 0	o25, 172	.032	.579	.002	.146	.272	1. 031	.011	1. 020	.072	1. 092	.502	.28	1. 13
3-year weighted average			801, 171	.033	.253	.001	.123	.252	.662	.017	.645	.050	.695	.625		

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
WYOMING—Continued																
Other pools																
1931	14–43	0.9–304.9	2,625,774	$0.110	$0.200	$0.007	$0.522	$0.264	$1.103	$0.037	$1.066	$0.160	$1.226	$0.715	—0	$3.50
1932	14–43	.7–205.4	2,415,221	.100	.180	.017	.504	.236	1.037	.027	1.010	.139	1.149	.709	$0.35	2.61
First 9 months of 1933	14–40	.8–127.6	1,448,292	.108	.197	.020	.476	.174	.975	.028	.947	.158	1.105	.490	.33	5.82
Last 3 months of 1933	14–40	.8–127.6	497,129	.145	.205	.011	.568	.190	1.119	.042	1.077	.139	1.216	.788	.21	2.95
1933	14–40	.8–127.6	2,128,034	.113	.199	.024	.490	.170	.996	.038	.958	.163	1.121	.569	.21	5.82
3-year weighted average			2,389,676	.108	.193	.015	.506	.227	1.049	.034	1.015	.154	1.169	.669		
TOTAL WYOMING																
1931			10,001,171	.266	.208	.050	.333	.181	1.038	.049	.989	.179	1.168	.906		
1932			8,532,716	.256	.199	.054	.332	.180	1.021	.052	.969	.163	1.132	.984		
First 9 months of 1933			5,397,393	.266	.213	.057	.321	.155	1.012	.034	.978	.165	1.143	.788		
Last 3 months of 1933			2,310,905	.242	.204	.043	.331	.153	.973	.064	.909	.129	1.038	.876		
1933			8,004,503	.253	.211	.053	.324	.151	.992	.044	.948	.159	1.107	.807		
3-year weighted average			8,846,130	.259	.205	.053	.330	.172	1.019	.048	.971	.167	1.138	.901		
MONTANA																
Cat Creek pool																
1931	50–50	7.0–8.1	93,795	.001	.112		.404	.266	.783	.017	.766	.027	.793	1.375	.74	.85
1932	50–50	7.0–7.0	74,817	.002	.132		.364	.339	.837	.022	.815	.024	.839	1.310	.83	.85
1933	50–50	6.8–6.8	39,569	.004	.235		.246	.260	.745	.045	.700	.030	.730	1.371	.73	.73
3-year weighted average			69,394	.003	.142		.359	.291	.795	.024	.771	.026	.797	1.351		
Pondera pool																
1931	28–35	3.1–16.2	518,690	.097	.266	.011	.390	.351	1.115	.023	1.092	.134	1.226	.814	.78	1.89
1932	28–35	2.7–50.0	410,297	.139	.308	.017	.381	.302	1.147	.038	1.109	.137	1.246	.906	.80	1.74
First 9 months of 1933	28–35	2.0–11.4	262,790	.154	.290	.017	.364	.218	1.043	.036	1.007	.125	1.132	.779	.48	1.73
Last 3 months of 1933	28–35	2.0–11.4	80,784	.161	.305	.012	.436	.233	1.147	.023	1.124	.136	1.260	1.188	.63	1.68
1933	28–35	2.0–11.4	357,088	.160	.291	.015	.375	.222	1.063	.031	1.032	.127	1.159	.872	.48	1.73
3-year weighted average			428,692	.128	.286	.014	.383	.300	1.111	.030	1.081	.133	1.214	.860		

Kevin-Sunburst pool																
1931	29–36	1.9– 10.0	366,400	.127	.198	.044	.447	.269	1.085	.092	.993	.248	1.241	.984	.32	1.75
1932	29–36	1.9– 7.0	284,383	.124	.246	.045	.467	.260	1.142	.072	1.070	.288	1.358	1.002	.49	2.39
First 9 months of 1933	29–33	1.3– 6.2	179,131	.078	.217	.045	.430	.177	.947	.072	.875	.287	1.162	.841	.42	2.45
Last 3 months of 1933	29–33	1.3– 6.2	55,284	.151	.333	.046	.634	.343	1.507	.211	1.296	.310	1.606	1.341	.62	2.48
1933	29–36	1.3– 6.2	248,821	.100	.237	.042	.466	.219	1.064	.100	.964	.283	1.247	.965	.42	2.48
3-year weighted average			299,868	.119	.224	.044	.459	.252	1.098	.088	1.010	.270	1.280	.985		
Other pools																
1931	44–52	6.4– 19.0	253,680	.065	.383	.137	.666	.373	1.624	.028	1.596	.208	1.804	.966	1.74	2.72
1932	40–52	3.7– 18.0	283,494	.033	.304	.246	.757	.208	1.548	.085	1.463	.350	1.813	1.163	1.03	3.58
First 9 months of 1933	30–52	5.1– 43.0	209,099	.037	.281	.276	.628	.176	1.398	.092	1.306	.519	1.825	.945	.16	3.07
Last 3 months of 1933	30–52	5.1– 43.0	100,151	.025	.227	.194	.370	.198	1.014	.124	.890	.368	1.258	1.368	−0	2.94
1933	30–52	5.1– 43.0	309,250	.033	.263	.250	.544	.184	1.274	.102	1.172	.470	1.642	1.082	−0	3.07
3-year weighted average			282,141	.043	.313	.215	.652	.248	1.471	.074	1.397	.351	1.748	1.074		
TOTAL MONTANA																
1931			1,232,565	.092	.258	.046	.465	.325	1.186	.044	1.142	.175	1.317	.939		
1932			1,052,991	.097	.278	.085	.504	.268	1.232	.059	1.173	.227	1.400	1.030		
First 9 months of 1933			651,020	.096	.267	.108	.467	.193	1.131	.064	1.067	.296	1.363	.850		
Last 3 months of 1933			236,219	.101	.279	.097	.454	.244	1.175	.110	1.065	.275	1.340	1.300		
1933			954,728	.097	.266	.098	.448	.210	1.119	.073	1.046	.275	1.321	.985		
3-year weighted average			1,080,095	.095	.266	.074	.473	.273	1.181	.057	1.124	.221	1.345	.982		
COLORADO																
Fort Collins and Wellington pools																
1931	33–37	14.7– 28.9	289,525	.277	.565	.158	.344	.386	1.730	.180	1.550	.424	1.974	.553	1.75	5.50
1932	33–37	18.7– 23.9	236,228	.351	.669	.191	.353	.307	1.871	.097	1.774	.459	2.233	.777	2.02	5.95
First 9 months of 1933	33–37	20.9– 22.1	138,084	.014	.812	.092	.338	.288	1.544	.037	1.507	.393	1.900	.413	1.64	2.88
Last 3 months of 1933	33–37	20.9– 22.1	43,830	.025	.838		.289	.302	1.454	.042	1.412	.412	1.824	.893	1.71	2.14
1933	33–37	20.9– 22.1	181,914	.017	.818	.070	.326	.291	1.522	.038	1.484	.398	1.882	.528	1.64	2.88
3-year weighted average			235,889	.235	.665	.147	.342	.335	1.724	.116	1.608	.429	2.037	.621		
Iles pool																
1931	31–31	48.0– 64.0	286,721	.052	.214		.120	.377	.763	.008	.755	.077	.832	.505	.74	1.22
1932	31–31	31.9– 40.8	178,269	.092	.307		.161	.368	.928	.017	.911	.095	1.006	.582	.98	1.08
First 9 months of 1933	31–33	40.3– 52.4	98,248	.102	.219		.198	.281	.800	.014	.786	.105	.891	.422	.81	1.06
Last 3 months of 1933	31–33	40.3– 52.4	44,193	.093	.169	.073	.179	.287	.801	.016	.785	.078	.863	.898	.87	.87
1933	31–33	40.3– 52.4	142,441	.099	.204	.023	.192	.283	.801	.015	.786	.096	.882	.570	.75	1.01
3-year weighted average			202,477	.074	.239	.005	.149	.353	.820	.012	.808	.087	.895	.543		

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*—Continued

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
COLORADO—Continued																
Moffat pool																
1931	39–39	62.0– 62.0	190,096	$0.008	$0.157	$0.040	$0.243	$0.494	$0.942	$0.004	$0.938	$0.080	$1.018	$0.557	$1.02	$1.02
1932	39–39	52.0– 52.0	139,718	.011	.221	.041	.266	.322	.861	.015	.846	.102	.948	.892	.95	.95
First 9 months of 1933	39–39	35.5– 35.5	95,925	.003	.211	.045	.242	.279	.780	.003	.777	.090	.867	.534	.87	.87
Last 3 months of 1933	39–39	35.5– 35.5	28,435	.007	.212	.047	.290	.279	.835	.012	.823	.102	.925	1.054	.92	.92
1933	39–39	35.5– 35.5	124,360	.004	.211	.046	.252	.279	.792	.005	.787	.093	.880	.653	.87	.92
3-year weighted average			151,391	.008	.191	.042	.253	.382	.876	.007	.869	.090	.959	.686		
Other pools																
1931	30–51	3.6–369.1	421,201	.171	.211	.069	.327	.372	1.150	.032	1.118	.137	1.255	.664	.81	4.45
1932	30–41	1.6–124.3	314,062	.150	.259	.100	.377	.325	1.211	.041	1.170	.154	1.324	.846	.74	2.39
First 9 months of 1933	30–43	2.3– 64.2	188,878	.183	.350	.085	.355	.296	1.269	.022	1.247	.161	1.408	.554	.36	3.01
Last 3 months of 1933	30–43	2.6– 64.2	53,258	.213	.378	.090	.372	.276	1.329	.030	1.299	.191	1.490	1.004	.32	7.96
1933	30–43	2.3– 64.2	242,136	.190	.356	.086	.359	.292	1.283	.024	1.259	.168	1.427	.653	.32	7.96
3-year weighted average			325,800	.169	.202	.083	.351	.337	1.202	.033	1.169	.150	1.319	.720		
TOTAL COLORADO																
1931			1,187,543	.142	.290	.069	.267	.396	1.164	.057	1.107	.183	1.290	.581		
1932			868,277	.170	.374	.095	.308	.329	1.276	.047	1.229	.217	1.446	.781		
First 9 months of 1933			521,135	.090	.422	.064	.300	.288	1.164	.021	1.143	.199	1.342	.488		
Last 3 months of 1933			169,716	.098	.415	.055	.287	.286	1.141	.027	1.114	.204	1.318	.956		
1933			690,851	.092	.420	.061	.297	.288	1.158	.022	1.136	.200	1.336	.603		
3-year weighted average			915,557	.139	.349	.075	.288	.347	1.198	.045	1.153	.198	1.351	.650		
TOTAL ROCKY MOUNTAIN																
1931			12,421,279	.237	.221	.051	.340	.215	1.064	.049	1.015	.179	1.194	.878		
1932			10,453,984	.222	.222	.060	.347	.201	1.063	.052	1.011	.174	1.185	.972		
First 9 months of 1933			6,569,548	.235	.235	.062	.334	.170	1.036	.036	1.000	.180	1.180	.770		
Last 3 months of 1933			2,716,840	.221	.223	.048	.339	.170	1.001	.065	.936	.147	1.080	.918		
1933			9,650,082	.227	.231	.058	.334	.167	1.017	.045	.972	.172	1.144	.810		
3-year weighted average			10,841,782	.233	.224	.056	.340	.197	1.050	.049	1.001	.175	1.176	.888		

TOTAL ILLINOIS																
1931	28–45	.2– 4.4	3,438,421	.051	.236	.016	.771	.331	1.405	.025	1.380	.100	1.480	.848	.35	2.05
1932	28–45	.1– 4.8	3,212,393	.057	.213	.019	.708	.195	1.192	.024	1.168	.093	1.261	1.016	.50	2.47
First 9 months of 1933	28–45	.1– 3.2	2,088,245	.057	.262	.014	.591	.179	1.103	.021	1.082	.106	1.188	.745	.62	2.40
Last 3 months of 1933	28–45	.1– 3.2	803,555	.059	.250	.016	.663	.216	1.204	.024	1.180	.091	1.271	1.203	.63	2.31
1933	28–45	.1– 3.2	2,921,527	.057	.257	.014	.613	.189	1.130	.022	1.108	.101	1.209	.873	.62	2.40
3-year weighted average			3,190,780	.055	.235	.017	.702	.241	1.250	.023	1.226	.098	1.324	.912		
TOTAL INDIANA																
1931	30–46	.4– 15.0	469,131	.051	.389	.138	.509	.269	1.356	.038	1.318	.148	1.466	.909	.70	2.02
1932	30–46	.3– 24.0	488,022	.046	.305	.126	.468	.200	1.145	.034	1.111	.112	1.223	1.057	.37	1.80
First 9 months of 1933	30–46	.5– 22.0	285,093	.044	.354	.088	.437	.168	1.091	.024	1.067	.119	1.186	.781	.19	1.99
Last 3 months of 1933	30–46	.5– 22.0	132,298	.044	.259	.156	.473	.147	1.079	.019	1.060	.085	1.145	1.204	.24	2.77
1933	30–46	.5– 22.0	443,300	.053	.323	.107	.441	.162	1.086	.026	1.060	.112	1.172	.915	.19	2.77
3-year weighted average			466,818	.050	.339	.124	.473	.212	1.198	.033	1.165	.124	1.289	.963		
OHIO																
1931	36–48	.2– 4.7	2,313,207	.132	.336	.337	.657	.352	1.814	.156	1.658	.375	2.033	1.040	.77	6.37
1932	36–48	.1– 11.4	1,981,612	.125	.326	.331	.610	.273	1.665	.159	1.506	.390	1.896	1.138	.51	4.28
First 9 months of 1933	36–48	.2– 7.9	1,308,941	.122	.329	.316	.659	.255	1.681	.164	1.517	.397	1.914	.939	.68	5.29
Last 3 months of 1933	36–48	.2– 7.9	434,063	.132	.344	.428	.727	.241	1.872	.204	1.668	.400	2.068	1.486	.25	4.86
1933	36–48	.2– 7.9	1,756,776	.128	.330	.341	.675	.252	1.726	.176	1.550	.398	1.948	1.074	.25	5.29
3-year weighted average			2,017,198	.129	.331	.336	.647	.297	1.740	.163	1.577	.387	1.964	1.082		
MICHIGAN																
1931	33–44	.7–143.7	1,854,823	.017	.217	.142	.101	.454	.931	.006	.925	.084	1.009	.713	.20	5.70
1932	33–44	.6– 58.9	3,500,685	.004	.123	.095	.081	.309	.612	.004	.608	.038	.646	.744	.39	5.32
First 9 months of 1933	33–44	.4–160.0	2,500,107	.004	.139	.130	.111	.236	.620	.004	.616	.041	.657	.864	.20	4.10
Last 3 months of 1933	33–44	.4–200.0	1,241,160	.004	.073	.111	.088	.269	.545	.005	.540	.028	.568	1.003	.16	7.56
1933	33–44	.4–200.0	3,745,816	.004	.117	.124	.104	.247	.596	.005	.591	.037	.628	.910	.16	7.56
3-year weighted average			3,033,775	.007	.140	.116	.095	.313	.671	.004	.666	.046	.712	.806		
KENTUCKY																
Western																
1931	33–42	.2– 17.2	871,451	.104	.117	.145	.266	.300	.932	.008	.924	.099	1.023	.708	.13	3.71
1932	33–42	.2– 13.1	965,724	.093	.180	.155	.337	.263	1.028	.025	1.003	.131	1.134	.904	.21	3.16
First 9 months of 1933	33–42	.1– 5.8	538,392	.095	.248	.086	.318	.254	1.001	.026	.975	.164	1.139	.732	.37	2.98
Last 3 months of 1933	33–42	.1– 5.8	148,215	.114	.282	.159	.461	.282	1.298	.012	1.286	.187	1.473	1.133	.76	4.10
1933	33–42	.1– 5.8	697,783	.097	.260	.100	.350	.256	1.063	.022	1.041	.168	1.209	.815	.37	4.10
3-year weighted average			844,986	.098	.180	.137	.316	.274	1.005	.019	.986	.131	1.117	.812		

TABLE 3.—*Crude petroleum: Unit cost of production and sales value by pools and districts, 1931–33*

Cost period	Range of gravity	Range of production per well per day (barrels)	Production—(company interest, barrels)	Expenses						Deduct gas sales and miscellaneous revenue	Net cost	Interest on invested capital	Net cost including interest	Average selling price	Range of costs	
				Depletion	Depreciation	Amortization of intangible development costs	Operating cost	General overhead and administrative	Total cost						Lowest	Highest
KENTUCKY—Continued																
Eastern																
1931	35–41	.1– 3.5	1,559,910	$0.369	$0.231	$0.021	$0.334	$0.253	$1.208	$0.016	$1.192	$0.286	$1.478	$0.852	$0.77	$3.79
1932	36–41	.1– 2.7	1,212,345	.401	.206	.003	.326	.195	1.131	.023	1.108	.315	1.423	.908	.52	4.20
First 9 months of 1933	36–41	.3– 3.1	791,838	.375	.208	.007	.306	.173	1.069	.017	1.052	.321	1.373	.668	.46	1.87
Last 3 months of 1933	36–41	.3– 3.1	253,048	.391	.237	.008	.393	.201	1.230	.038	1.192	.335	1.527	1.227	.50	1.98
1933	36–41	.3– 3.1	1,078,060	.376	.220	.007	.330	.175	1.108	.023	1.085	.321	1.406	.805	.46	1.98
3-year weighted average			1,283,438	.381	.220	.012	.330	.213	1.156	.020	1.136	.304	1.440	.857		
TOTAL KENTUCKY																
1931			2,431,361	.274	.190	.065	.310	.270	1.109	.013	1.096	.219	1.315	.800		
1932			2,178,069	.264	.195	.070	.331	.225	1.085	.023	1.062	.233	1.295	.906		
First 9 months of 1933			1,330,230	.262	.224	.039	.311	.206	1.042	.020	1.022	.257	1.279	.694		
Last 3 months of 1933			401,263	.289	.254	.064	.418	.230	1.255	.028	1.227	.280	1.507	1.192		
1933			1,775,843	.266	.236	.044	.338	.207	1.091	.023	1.068	.260	1.328	.809		
3-year weighted average			2,128,424	.269	.204	.061	.325	.237	1.096	.019	1.077	.235	1.312	.839		
WEST VIRGINIA																
1931	35–48	.1– 3.7	2,724,241	.091	.422	.123	1.182	.433	2.251	.477	1.774	.394	2.168	1.575	1.26	8.07
1932	35–48	.1– 3.3	2,436,616	.087	.429	.110	1.218	.360	2.204	.467	1.737	.393	2.130	1.572	1.18	4.82
First 9 months of 1933	35–48	.1– 3.0	1,669,525	.063	.376	.105	1.138	.383	2.065	.445	1.620	.386	2.006	1.384	1.08	4.42
Last 3 months of 1933	35–47	.1– 3.9	577,444	.068	.376	.093	1.293	.374	2.204	.433	1.771	.371	2.142	2.113	.64	5.48
1933	35–48	.1– 3.9	2,246,969	.064	.376	.102	1.178	.381	2.101	.442	1.659	.382	2.041	1.571	.64	5.48
3-year weighted average			2,469,275	.081	.411	.112	1.193	.393	2.190	.463	1.727	.390	2.117	1.573		

PENNSYLVANIA																
1931	32–49	.03– 3.6	7,485,843	.234	.351	.198	.648	.209	1.640	.055	1.585	.522	2.107	2.001	.42	8.94
1932	32–49	.04– 2.9	8,654,518	.251	.332	.211	.562	.188	1.544	.041	1.503	.431	1.934	1.870	.42	9.78
First 9 months of 1933	36–46	.05– 3.6	6,273,726	.256	.332	.215	.530	.189	1.522	.039	1.483	.402	1.885	1.675	.78	101.76
Last 3 months of 1933	32–47	.05– 3.6	2,337,788	.265	.317	.319	.589	.174	1.664	.037	1.627	.363	1.990	2.426	.51	13.59
1933	32–47	.05– 5.0	8,813,987	.259	.327	.241	.546	.181	1.554	.039	1.515	.393	1.908	1.878	.51	101.76
3-year weighted average			8,318,116	.249	.336	.217	.582	.192	1.576	.044	1.532	.445	1.977	1.912		
NEW YORK																
1931	42–45	.3– 1.5	847,253	.341	.341	.076	.511	.253	1.522	.008	1.514	.535	2.049	2.140	.65	5.25
1932	42–45	.2– 1.9	1,005,850	.323	.337	.121	.485	.184	1.450	.009	1.441	.490	1.931	1.896	.78	4.15
First 9 months of 1933	42–45	.2– 1.6	540,081	.318	.325	.098	.450	.194	1.385	.008	1.377	.549	1.926	1.679	.49	6.29
Last 3 months of 1933	42–45	.2– 1.6	170,788	.315	.287	.237	.562	.246	1.647	.017	1.630	.524	2.154	2.393	.42	5.59
1933	42–45	.2– 1.6	792,417	.327	.321	.127	.479	.196	1.450	.009	1.441	.541	1.982	1.834	.42	6.29
3-year weighted average			881,840	.330	.333	.108	.491	.211	1.473	.009	1.464	.520	1.984	1.955		
TOTAL EASTERN AREA																
1931			21,564,280	.162	.311	.148	.643	.303	1.567	.103	1.464	.343	1.807	1.396		
1932			23,457,765	.160	.281	.148	.556	.236	1.381	.085	1.296	.296	1.592	1.387		
First 9 months of 1933			15,995,948	.158	.288	.152	.524	.222	1.344	.081	1.263	.293	1.556	1.239		
Last 3 months of 1933			6,098,359	.155	.260	.201	.558	.228	1.402	.077	1.325	.255	1.580	1.770		
1933			22,496,635	.159	.280	.164	.534	.221	1.358	.079	1.279	.284	1.563	1.388		
3-year weighted average			22,506,227	.160	.291	.154	.576	.252	1.433	.089	1.344	.307	1.651	1.390		
TOTAL ALL STATES																
1931			558,296,833	.084	.160	.037	.220	.347	.848	.063	.785	.109	.894	.643		
1932			517,586,938	.081	.152	.043	.213	.264	.753	.059	.694	.114	.808	.858		
First 9 months of 1933			421,592,211	.073	.132	.054	.175	.211	.645	.051	.594	.105	.699	.578		
Last 3 months of 1933			134,151,408	.076	.139	.056	.221	.241	.733	.074	.659	.113	.772	.992		
1933			566,448,664	.073	.134	.054	.187	.217	.665	.056	.609	.108	.717	.678		
3-year weighted average			547,444,145	.079	.148	.045	.207	.276	.755	.059	.696	.110	.806	.723		

III. PHYSICAL LAWS CAUSING MIGRATION AND DRAINAGE IN AN OIL FIELD

1. Federal Oil Conservation Board, *Report III*, 1929:

[Page 21 et seq.]

VALUE OF ORIGINAL GAS

Gas in an oil sand should be looked on primarily as a source of energy rather than as a substance. This stored energy is the prime motive force for the extraction of the oil from the reservoir. It drives the oil through the minute pore spaces of the reservoir rock to the well and lifts or helps to lift it to the surface.

Gas has a second and almost equally important value—its value in increasing the fluidity of the oil. As already noted, part of the gas in an oil sand may be in liquid form; part may be dissolved in the oil. The amount that may be dissolved depends upon the character of the oil and the character of the gas and is proportional to the temperature and the pressure.

The greater the amount of dissolved and liquid gas in an oil, the lighter the oil, the less viscous, and the lower its surface tension. Specific gravity viscosity and surface tension of the oil are all lessened by the solution of the gas, and as these are lessened the mobility of the oil is increased. Rendered more fluid by the gas, the oil can pass through the intricate, tortuous interstices of the reservoir and find its way to the area of lower pressure at the well. Greater fluidity, greater mobility, greater ease of movement—these represent the solution value of gas in oil.

It will be noted how these two values supplement one another. The gas makes the oil easier to move; the energy in the gas moves it. These two properties of gas are of prime importance in the production of oil.

When a well penetrates a petroleum reservoir theretofore untouched gas pressure is released about the well, and oil and gas begin to flow through the reservoir spaces toward the point of lowered pressure. As the fluid moves toward the well there is a progressive drop in pressure. With the drop in pressure the free gas expands and drives the oil through the sand; the dissolved gas comes out of solution and becomes free gas; the liquified gas vaporizes and becomes free gas; and the additional free gas also helps to drive the oil to the well. The progressive liberation of energy increases the velocity of the fluids and overcomes friction as they move through the rock voids toward the point of egress.

It is logical to assume that those winding pore channels which have the greater and more uniform cross section will carry a more mobile fluid, a fluid with a greater proportion of gas, than the other channels, and that this gas portion is augmented by distillation from neighboring channels. The natural gas in endeavoring to escape from the reservoir in such a way as to reduce the stored energy attempts to clear those larger and more uniform pore channels of petroleum, which, when cleared, will permit the free egress of the remaining gas to and out of the well, leaving a maximum of petroleum in the reservoir. If the pressure is too rapidly reduced by permitting too rapid escape of gas from

98810—34——7

the well the proportion of oil left in the reservoir is increased.

As the pressure is lowered and the dissolved and liquid gas leave the oil, the oil becomes more viscous and increasingly difficult to move, and this augments the tendency to leave more oil in the reservoir if the pressure is too rapidly exhausted.

As the production declines the proportion of gas produced with the oil—the gas-oil ratio—increases, and the gas energy declines below the point necessary to flow the well. Thus the flush or flowing period of the field passes.

As the field declines pressures are lower than during the flush period and is not so plentiful or so mobile. Gradually oil accumulates in the bottom of the well and the surrounding sand and obstructs the passage of the gas. Pressure is built up behind the oil and when this pressure is great enough the well again flows, the sand near the well is again depleted, and the cycle is repeated. This is the period of intermittent flow.

Finally the amount of oil reaching the well and the amount of gas and gas pressure behind it are not great enough to cause even intermittent flow. Gravity begins to play a more important part in the movement of the oil, especially if the reservoir body be thick. The oil is less mobile, all the gas energy is utilized in bringing the oil to the well, and artificial means must be employed for lifting it. The well has reached the pumping stage.

It is readily seen that throughout the well history the gas present in the oil has facilitated movement toward the well, and that, except for the part that may have been played by other forces such as

water and gravity, movement has depended entirely on the gas energy.

In many fields the gas pressure has played a third important role in holding back edge or bottom water or both and preventing its encroachment into the productive parts of the sand. When the gas pressure declines below the hydrostatic head of the water, friction alone delays the water in flooding the field.

2. Ely, *Oil Conservation through Interstate Agreement* (Federal Oil Conservation Board):

[Page 3, et seq.]

THE DOCTRINE OF CAPTURE

An oil pool is a reservoir of oil, gas, and gas in solution. It becomes also a gas and hydraulic engine when the first well disturbs the equilibrium of hydraulic, gas, and rock pressures which was necessary for the retention of the pool in that particular place. Wells drilled into various parts of the field will produce gas or oil or both; or water, or oil and water; or will strike dry strata, all depending on their location. The maximum ultimate recovery of oil can be effected only by control of spacing, drilling, and producing of wells so as to utilize these reservoir forces for the production of oil, rather than permitting the dissipation of gas or the "channeling" of water through the oil sands to the wells. All this is now elementary, but the decisions which shaped our law ignored it.

The single oil pool is the natural unit of property, but not the common-law unit. Instead, on early and fanciful analogies to wild game, supple-

mented later by equally erroneous analogies to solid minerals, and by an unfortunate early example of harsh logic from the English law of percolating waters, our courts have universally recognized that whatever one landowner could withdraw (by natural means at least) from the common pool he could take and keep, regardless of the effect on his neighbors; and that their only defense was to "do likewise"; that is, drill and produce. * * *

This unfortunate rule originated in Pennsylvania at a time when that State was a recent convert to the harsh English rule of percolating waters, which protects no well owner against the withdrawals of another. It is now entrenched in the law of oil and gas even in those States which have established the American doctrine of correlative rights and reasonable use as to percolating waters, with the possible but not very probable exception of California. In its broadest phase, the rule of capture recognized no right to protection against even the malicious waste of gas; the law of oil and gas took root when even engineers knew but little of the forces with which they were dealing, and the lawyers less. * * * The rule, however, must be dealt with as it exists, as even the most advanced conservation cases recognize. In *Champlin Ref. Co.* v. *Corpn. Comm.,* cited below, the United States Supreme Court said: "Where proportional taking from the wells in flush pools is not enforced, operators who do not have physical or market outlets are forced to produce to capacity in order to prevent draining to others having adequate outlets."

In practical application the capture rule, recognizing no right in a landowner to retain his oil and

gas in place against his neighbor, and hence no protection against drainage except by offset drilling, forces oil into the market in response to the number of offset wells rather than the market demand. The remedy of these neighbors is not injuction, nor accounting, nor receivership of the offending wells; it is offset drilling, whether the oil thereby produced can be sold at profitable prices or at all. And the remedy of the neighbors of these neighbors is to drill also; so that everyone in the field, to use Henry L. Doherty's expression, must compete in the run on the bank. Since the operator having the readiest outlet presumably drills the most wells and produces the most oil, his neighbors, required to offset, must collectively produce at a rate which is automatically higher than the average demand of all outlets, or else they must lose their oil. They cannot hold for better times; therein their business differs from that of the producer of coal, copper, or iron. The doctrine of capture is thus the first artificial factor which sets the oil industry apart and calls for legislative correction. To quote the Federal Oil Conservation Board:

"Both the immediate potential supply of crude oil and the quantity recoverable over a period of years are dependent upon a factor which no State has found means to effectively control, and which stimulates production without direct relationship to the demand for oil—the system of offset drilling necessitated by the prevalent doctrines of ownership. An oil pool, being a physical unit, is subject to drainage by any surface owner regardless of the oil content of his acreage. In the absence of statute or agreement, the only recourse of a co-owner is to

compete for capture by offset drilling. The State's authority to control this basic factor, drilling, is largely untested, except for some successful efforts to control spacing of wells."

THE RELATIONSHIP OF LESSOR AND LESSEE

The second artificial factor arises not from the relationship between adjoining landowners but from the separation of interests between landowners and lessees of the same tract. Landowners, without resources to drill wells, generally lease to operators the privilege to do so. Leases vary greatly in form, from conveyances of a separate mineral estate to licenses to explore. In practically all of them, however, the lessor's return is his royalty on production, and the lessee is under certain obligations which constitute collectively the second artificial factor under consideration—the lessee's express and implied covenants. As this factor is one theoretically capable of control by agreement, and is more of a consequence of the doctrine of capture than it is an independent factor, no attention will be paid to it here except to point out some of the consequences.

Consideration may be omitted here of those covenants attaching before production is struck. Once a discovery is made, certain implied covenants become enforceable on behalf of the lessor, all of them impelling production and limiting the lessee's power to leave oil in the ground even if he wished to do so. The principal covenants exerting particular pressure toward market are the following:

First, there is an implied covenant to produce for market.

Second, there is an implied covenant to continue to drill and develop the leased land after discovery.

Third, there is an implied covenant to drill and produce offset wells to protect the premises from drainage.

The consequences of breach of these conditions vary in different jurisdictions, but in general the penalty is damages or forfeiture unless, in particular circumstances, the courts permit the lessee to show that more wells would not pay for themselves. These implied covenants spring, in part, from the doctrine of capture—a landowner can prevent the drainage of his land only by draining it himself, and his lessee must either do it for him, or get off, or pay damages.

In outlining here these present and existing factors which lead to the dissipation of a pool entirely without relation to market demand, it is useless to dwell on the fact that the inception of the doctrine of capture was an avoidable accident.

IV. OVERPRODUCTION IN EAST TEXAS

1. Federal Oil Conservation Board, *Report V*, 1932:

[Page 42 et seq.]

THE EAST TEXAS FIELD

The early stages of development in the east Texas field offered an outstanding example of wasteful competitive development and premature withdrawal of underground reserves. A true picture of the significance and real effect of current devel-

opment practices in east Texas upon the economic structure will have better proportion when viewed through the perspective of years. However, a review of available facts will help formulation of definite opinions regarding the effect of this development and withdrawal on oil and gas conservation.

The east Texas area began to draw the interest of the petroleum industry, and shortly thereafter the attention of the public generally, upon the successful completion on October 3, 1930, of the Joiner "discovery" well, in Rusk County, Tex., at a reported depth of 3,592 feet. Within a year from the discovery of oil at this relatively shallow depth, in what geologists have now agreed is the Woodbine formation, the proved limits of the field had been extended to an area some 35 miles long and 3 to 7½ miles wide with more than 2,200 completed wells and 780 active drilling operations under way. During one week at the end of the first year of development nearly 200 new locations for derricks were made.

For a time, lack of control in all its phases—engineering, economic, political, and personal—seemed to predominate in the east Texas area, but it should not be inferred that there were no honest attempts to conserve this vast reservoir of oil, and those efforts have not been useless.

Contemplation of the east Texas area leads to the use of superlatives. In introducing a discussion covering the east Texas oil field, sponsored by the East Texas Geological Society and the Dallas, Tex., petroleum geologists, the statement was made:

Today (December 1931) east Texas stands as the greatest field in all oil-producing history; greatest

in area; greatest in daily potential; greatest in future reserves; greatest in threat to the oil-producing business; and, if production is not restricted, it will be the greatest in waste of natural resources.

The areal proportions of the east Texas field and its size compared with other major oil fields in the United States are evident in the accompanying map, figure 3, reproduced in this report through the courtesy of Hudnall & Pirtle, consulting geologists.

The whole gamut of controversial questions has been run in attempting to determine equitable and rational production of oil. Although many groups, organizations, and official and semiofficial bodies have been called together in an effort to solve the economic and technical problems of east Texas, in essence the main differences of opinion seem to have been between the proponents of some form of proration or "allowable withdrawal" of oil from the field and the advocates of competitive drilling and unrestricted production programs, sometimes referred to as the "antiprorationists." Many plans have been proposed to permit "allowable withdrawal", or to develop the field as a unit, or several units. Public opinion in the east Texas area, however, has not reached a point where all interested parties are receptive to the suggestion that oil and gas operations be conducted under a unit plan. As an outgrowth of conditions in certain areas of the field during the summer of 1931, the Governor of Texas called out the State militia on August 17, and the field was shut down. Injunctions followed and the settlement of these matters is still pending in the higher courts. When the field was reopened on

September 5, an allowable production of 225 barrels per well per day was established by the Railroad Commission. This allowable production has been reduced gradually and as of May 16, 1932, each well was allowed to produce 59 barrels per day, an allowable production for the field of about 325,000 barrels daily.

Accurate estimates of reserves in fields under prorated production are difficult to obtain because of factors which did not appear when fields were produced to commercial depletion through natural decline, and no one method now in existence seems adequate for general application. Nevertheless, methods are being evolved which permit making fairly accurate approximations of ultimate recovery. According to the averaged figures of some 60 geologists and engineers, who have studied the east Texas oil field intensively and who discussed recoveries from that field at an open meeting in Tyler, Tex., December 17, 1931:

The east Texas field at present comprises an area of 98,250 proven acres, of which approximately 50,000 acres are considered the "heart of the field." In this 50,000 acres, the average maximum thickness of saturated sand actually recovered in cores is 40 feet, the average maximum drilled is 70 feet, porosity ranged from 20 to 31 percent, the estimated average recovery is 40 percent, and an estimated average ultimate yield of 30,322 barrels per acre is arrived at.

The remaining or edge 50,000 acres is estimated to have an average pay sand thickness of 18.4 feet and an estimated average ultimate yield of 12,000 barrels per acre. The total ultimate production of the field is estimated at 2,100,000,000 barrels.

Statistics compiled by the United States Bureau of Mines show the cumulative production from the east Texas field to April 1, 1932, to be 137,444,000 barrels. In February 1932 there were 706 operators, 1,980 producing leases, and 4,352 producing wells. On May 15, 1932, the number of producing wells was approximately 5,520.

Assuming a potential reserve of approximately 2 billion barrels, the cumulative production to April 1, 1932 (137,444,000 barrels), represents a depletion of 6.87 percent.

The original bottom-hole pressures were above 1,600 pounds per square inch, as estimated from readings of recording instruments which were not run in the wells. Bottom-hole pressure gages now in use show that in parts of the field the reservoir pressure has declined below 800 or 900 pounds per square inch, and some wells have stopped flowing.

The rapid decline in reservoir pressures demonstrates the detrimental effect of competitive development and rapid withdrawal. Oil in the east Texas field has been referred to as "undersaturated"; that is, more gas, if it had been present in the formations, could have been dissolved in the oil under existing reservoir conditions. Because of this undersaturation the gas-oil ratios in the field are relatively low (300 to 450 cubic feet per barrel) and at present are fairly uniform throughout the field.

In this connection, penetration of the sand body is a factor that will influence the later productive life of the field. Today, wells of shallow penetration are "stripping off" the lighter and less viscous fractions, leaving the heavier and more viscous fractions to be recovered subsequently. Although

gas pressures are being lowered, making more difficult the recovery of the heavier fractions and probably lessening the ultimate recovery, nevertheless the menace of water encroachment in parts of the field makes inexpedient the deep or complete penetration of the sand body. Therefore, a balance must be struck between the conservation of gas and the hazard of water encroachment.

To obtain the maximum lifting efficiency of the gas that is dissolved in the oil a considerable amount of experimental work has been applied to the "choking" or restricting the flow of oil and gas at the bottoms of wells. Placing a restriction or "choke" at the bottom of the flow column creates a high differential pressure between the entrance and discharge sides of the aperture, thereby permitting gas to come out of solution. The expansive energy of this gas forces the oil to the surface. Although more study is needed with reference to bottom-hole "choking", it is believed that the principle has sound application to underground conditions in the east Texas area, and that the method promotes the maintenance of relatively high reservoir pressures and the prevention of irregular encroachment of water, as well as the saving and efficient use of expanding gas.

The water situation in the east Texas field is still problematical. At one time it was predicted that water would "flood the field" in a short time, and salt-water disposal methods were contemplated. Undoubtedly proration has retarded the encroachment, and ideas regarding a rapid water drive have been modified. Most of the engineers and geologists in the east Texas field agree "that a sufficient

hydrostatic head exists and that orderly and restricted production will be necessary to reduce the water problem to a minimum."

A report by the Railroad Commission of Texas for April 30, 1932, showed 96 wells making water in varying amounts. In general, these wells are located along and near the west edge of the field.

The foregoing review of conditions in the east Texas field shows the need for rational control to maintain the social and economic structure of the industry and to conserve the underground supply. Water encroachment has been retarded since methods of orderly production have been employed, and in consequence the ultimate recovery from the field has been increased over what it would have been if uncontrolled production had continued. However, the amount of this increase is not determinable. The ultimate effect of the east Texas field upon the economic structure depends upon how wisely the industry and the public permit rational methods of withdrawal to be applied during its remaining productive life.

2. Oil and Gas Journal, July 27, 1933, p. 35.—McIntyre, *Flush Fields and Illegal Oil Runs Responsible for Increased Production:*

* * * The increase in east Texas alone was 3,830,217 barrels in excess of the total increase in the United States over the first half of last year. The combined increase of production in east Texas, Oklahoma City, and Conroe, Tex., was 59,808,692 barrels, as against a total for the whole country of 39,022,180 barrels, indicating a falling off in other fields of 20,786,512 barrels.

Millions of barrels of oil produced in disregard of legal production allowables made by the Texas Railroad Commission and the Oklahoma Corporation Commission comprised much of the unexpectedly large production yielded by Texas and Oklahoma in the 6-month period. Regardless of price some producers got rid of all the oil they could find a market for, most of the crude going out in tank cars. Much of this oil was bought by brokers who gambled on selling it at a profit to refiners at various points of destination.

At the beginning of the year it was expected that production this year would be less than in 1932, and until the third week in February it appeared that the expectations would be realized. Then east Texas began to assert itself, and from a production of 10,459,555 barrels in January it changed to 17,355,872 barrels in March. It fell off to 10,916,250 barrels in April while potentials were being taken, but in May it hit its all-time peak for a month by pouring out 31,322,545 barrels, an average of more than 1,000,000 barrels per day, an unprecedented figure. A partial shut-down in June brought production down to 22,908,640 barrels.

The Texas Gulf coast also manifested a desire to run away with production, starting off in January with a record of 3,906,389 barrels or 126,013 barrels per day, and increasing steadily to an average of 182,231 barrels per day in May, the highest figure it ever reached. It ended the half year with an average of 176,038 barrels per day in June. The Conroe field was largely responsible for the increase, with some help from the Thompson field, formerly carried in these reports as the Rabbs Ridge Field.

In Oklahoma, the Oklahoma City field which produced 27,039,796 barrels in the first 6 months, exceeded its production in the same period last year by 8,852,528 barrels.

Crude-oil production in California during the half year was the lowest for any similar period since 1922, when production aggregated 61,092,778 barrels in the first half of that year. This half year's output was 84,407,535 barrels. Unfavorable marketing conditions in a part of the period were responsible for a lack of new wells and a decline in production. Kettleman Hills, the most interesting field in California at this time, produced about the same quantity of oil this year it did in the like period in 1932.

The accompanying table shows a total of 320,571 oil wells producing on June 30. Of these, 175,480 wells in New York, Pennsylvania, Ohio, West Virginia, Indiana, Illinois, and Kentucky produced an average of less than one-half barrel per day, and if we add to these eastern wells all the wells in Kansas and north central Texas, including flush, semiflush, and strippers, the combined 217,447 wells averaged only 1.2 barrels per day. Then add the 58,742 wells in Oklahoma and the combined daily average production of the 276,189 wells, including Oklahoma City's gushers, the good wells in the Greater Seminole district and other flush and semiflush wells, only reaches the 2½-barrel per day mark. If the flush and semiflush wells are taken out of the list, it would be easy to show 250,000 wells in the United States, the combined production of which did not average over 1 barrel per well per day.

Five producing divisions increased their production over the same period last year: Kansas, Oklahoma, east central Texas, east Texas, and the Gulf coast. The aggregate increase was 57,231,092 barrels. Against this all the others showed a decline, but of only 18,208,912 barrels, the greatest loss having been in California where production slumped 6,536,538 barrels. West Texas production declined 3,579,139 barrels. The detailed figures of gains and losses follow:

Increase in production

	Barrels
Kansas	1,355,032
Oklahoma	3,043,867
East central Texas	356,339
East Texas	42,852,397
Gulf Coast (Tex., La.)	9,623,457
Total increase	57,231,092

Decrease in production

New York	348,000
Pennsylvania	493,000
Ohio	290,000
West Virginia	264,000
Kentucky	778,000
Michigan	220,000
Tennessee	1,000
Indiana	137,000
Illinois	846,000
North central Texas	553,096
West Texas	3,579,139
Texas Panhandle	927,463
Southwest Texas	879,303
Arkansas	752,343
North Louisiana	33,216
Wyoming	1,064,974
Montana	121,464
Colorado	160,291
New Mexico	224,085
California	6,536,538
Total decrease	18,208,912

Summary of crude-oil production, in barrels, in United States, first 6 months of 1933

	1930, production first 6 months	1931, production first 6 months	1932, production first 6 months	1933, production first 6 months	Number of oil wells producing, June 30	Average daily production per well, 6 months
New York	2, 172, 000	1, 637, 000	1, 832, 000	1, 484, 000	14, 200	0. 58
Pennsylvania	7, 344, 000	5, 465, 000	6, 427, 000	5, 934, 000	78, 500	. 42
Ohio	3, 390, 000	2, 811, 000	2, 357, 000	2, 067, 000	36, 600	. 31
West Virginia	2, 792, 000	2, 210, 000	1, 996, 000	1, 732, 000	14, 300	. 67
Kentucky	3, 878, 000	3, 176, 000	2, 994, 000	2, 216, 000	14, 900	. 82
Michigan	2, 146, 000	1, 511, 000	2, 950, 000	2, 730, 000	680	49. 55
Tennessee	7, 000	4, 000	2, 000	1, 000		
Indiana	519, 000	409, 000	437, 000	300, 000	2, 380	. 70
Illinois	3, 010, 000	2, 283, 000	2, 610, 000	1, 764, 000	14, 600	. 67
Kansas	21, 220, 994	20, 070, 775	17, 902, 544	19, 257, 576	18, 875	5. 64
Oklahoma	117, 779, 527	95, 838, 677	77, 113, 805	80, 157, 672	58, 742	7. 54
North central Texas	24, 842, 224	15, 029, 694	13, 544, 129	12, 991, 033	23, 092	3. 11
West Texas	58, 824, 487	40, 690, 647	32, 807, 924	29, 228, 785	3, 048	52. 98
Texas Panhandle	17, 163, 665	10, 092, 312	9, 124, 081	8, 196, 618	1, 994	22. 71
East central Texas	5, 616, 731	8, 877, 881	9, 982, 024	10, 338, 363	923	61. 88
East Texas		31, 532, 184	60, 752, 039	103, 604, 436	10, 183	56. 21
Gulf Coast	35, 982, 479	31, 422, 135	24, 551, 304	34, 174, 761	3, 120	60. 52
Southwest Texas	12, 275, 729	13, 563, 721	11, 094, 330	10, 215, 027	4, 368	12. 92
Arkansas	10, 332, 347	8, 649, 636	6, 309, 267	5, 556, 924	2, 905	10. 57
North Louisiana	7, 259, 246	7, 227, 389	5, 269, 165	5, 235, 949	2, 423	11. 93
Wyoming	8, 927, 810	7, 814, 930	6, 602, 252	5, 537, 278	3, 702	8. 26
Montana	1, 646, 357	1, 501, 846	1, 196, 703	1, 075, 239	1, 452	4. 09
Colorado	850, 036	758, 242	614, 793	454, 502	191	13. 15
New Mexico	2, 511, 118	7, 522, 672	6, 610, 435	6, 386, 350	439	80. 37
Utah						
California	118, 402, 863	95, 675, 449	90, 944, 073	84, 407, 535	8, 954	52. 08
Total	468, 893, 613	415, 774, 190	396, 023, 868	435, 046, 048	320, 571	7. 50

Production of producing divisions, by months

	January	February	March	April	May	June	Total, 6 months
	Barrels	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Barrels*
California	14, 460, 282	13, 107, 043	13, 414, 980	14, 262, 943	14, 817, 633	14, 344, 654	84, 407, 535
Texas	26, 115, 932	25, 092, 383	34, 242, 444	27, 306, 582	49, 151, 776	39, 907, 737	201, 816, 854
Oklahoma	12, 550, 784	12, 570, 992	15, 455, 236	11, 720, 010	13, 521, 580	14, 339, 070	80, 157, 672
Kansas	2, 871, 282	2, 801, 512	3, 604, 539	3, 492, 990	3, 277, 103	3, 210, 150	19, 257, 576
Arkansas	993, 457	880, 208	943, 702	909, 120	928, 667	901, 770	5, 556, 924
Louisiana	2, 021, 117	1, 793, 443	2, 070, 695	2, 156, 736	2, 116, 296	2, 009, 831	12, 168, 118
Rocky Mountain	2, 241, 610	2, 096, 612	2, 371, 469	2, 209, 470	2, 294, 558	2, 239, 650	13, 453, 369
Eastern	3, 112, 000	2, 747, 000	3, 118, 000	3, 017, 000	3, 177, 000	3, 057, 000	18, 228, 000
Total, United States	64, 366, 464	61, 089, 193	75, 221, 065	65, 074, 851	89, 284, 613	80, 009, 862	435, 046, 048

[The figures in the table opposite this page are based in part upon the tables on pages 110 to 123 inclusive.]

a. Department of Commerce, Bureau of Mines, Mineral Resources of the United States, 1931, Part II (Crude Petroleum and Petroleum Products):

[Pages 565–566]

Production of crude petroleum by districts and States and daily average production in principal fields and States in 1931, by months

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	Total	Value at wells [1]
Appalachian:														
New York	251	241	264	269	268	286	275	257	299	324	291	338	3,363	6,800
Pennsylvania	936	850	924	935	942	937	935	941	1,087	1,204	1,072	1,129	11,892	23,550
West Virginia	379	346	376	376	373	380	365	347	381	415	352	382	4,472	7,070
East and southeast Ohio	391	356	389	375	368	364	313	290	345	355	322	344	4,212	4,600
Kentucky	551	525	688	515	477	486	478	461	555	591	615	514	6,456	5,295
Tennessee		2		1	1		1				1		6	5
Total, Appalachian	2,508	2,320	2,641	2,471	2,429	2,453	2,367	2,296	2,667	2,889	2,653	2,707	30,401	47,320
Lima-Indiana:														
Northwestern Ohio	105	91	93	93	93	100	98	82	95	98	78	89	1,115	1,010
Northeastern Indiana	4	4	3	3	4	3	2	3	3	3	3	2	37	20
Michigan	267	231	291	263	260	240	287	281	357	405	430	477	3,789	2,840
Total, Lima-Indiana	376	326	387	359	357	343	387	366	455	506	511	568	4,941	3,870
Illinois-Indiana:														
Southwest Indiana	70	66	58	66	66	75	72	64	67	67	64	68	803	730
Illinois	411	376	374	378	384	456	463	439	437	444	430	447	5,039	4,500
Total, Illinois-Indiana	481	442	432	444	450	531	535	503	504	511	494	515	5,842	5,230

[1] Thousands of dollars.

V. THE EFFECT OF OV

1. Average dai

1931 production figures taken from Department of Commerce, Bureau of Mines, Mineral Resources of the Uni
of Mines, Minerals Yearbook, 1932-1933, Statistical Appendix (Crude petroleum and petroleum products), p
These tables are all reprinted in Appendix B, pp. 110-112, 116-118, 121-123. Where daily average production is not d
Posted prices for 1931 taken from Department of Commerce, Bureau of Mines, Mineral Resources of the Unite
Mines, Minerals Yearbook, 1932-1933, Statistical Appendix (Crude petroleum and petroleum products), p. 334.
Petroleum News). Bureau of Mines' figures for 1933 have not as yet been published. Prices are given in dollars

[

	East Texas			Oklahoma City			Mid-Continent except east Texas and Oklahoma City			Dai aver prod tio
	Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		
		Date	Amount[1]		Date	Amount[2]		Date	Amount[3]	
1931										
January	3			82			1,161	Jan. 1	$1.01	
February	26			98			1,157			
March	98	Mar. 7	$0.63	140			1,138	Mar. 10	.63	
April	259			172			1,127			
May	315	May 26	.33	177			1,124			
June	363	June 20	.20	193			1,100	June 1	.35	
July	528			154			1,016	July 11	.20	
								July 23	.40	
August	446	Aug. 13	.25	24			922	Aug. 22	.66	
		Aug. 22	.68							
September	360			22			946			
October	417			116			1,003			
November	407	Nov. 2	.83	178			1,044	Nov. 2	.81	
December	362			167			1,019			
1932										
January	322			121			919			
February	312			99			945			
March	343			112			924			
April	358	Apr. 1	.98	103			970	Apr. 1	.92	
May	345			110			947			
June	353			95			940			
July	345			95			928			
August	334			75			935			
September	373			75			920			
October	367	Oct. 14	1.10	68			896	Oct. 15	1.04	
November	359			83			890			
December	173	Dec. 16	.75	73			860	Dec. 15	.88	
								Dec. 20	.69	
1933										
January	351	Jan. 20	.50	109			875	Jan. 18	.44	
February	387			149			887			
March	560			200			914			
April	369	Apr. 25	.10	103			912			
May	969	May 2[9]					859	May 6	.25	
		May 13	.25	134						
June	841	June 19	.50	202			929	June 17	.44	
July	646			278			949	July 8	.54	
August	608	Aug. 24	.60	268			960	Aug. 25	.64	
September	560	Sept. 6	.75	223			929	Sept. 6	.74	
		Sept. 8	.90					Sept. 8	.89	
		Sept. 29	1.00					Sept. 29	1.00	
October	525			195			860			
November	453			192			856			
December	451			188			847			

[1] 38°-38.9° gravity oil. 1933 prices from Oil Price Handbook, 1933, p. 152. Posted by Humble Oil and Refining
[2] Same as Mid-Continent.
[3] 38°-38.9° gravity oil in 1931; 36°-36.9° gravity oil in 1932 and 1933 (the change was necessitated by the change in t
[4] 1933 prices from Oil Price Handbook, 1933, p. 145. Posted by South West Pennsylvania Pipe Line.
[5] 1933 prices from Oil Price Handbook, 1933, p. 146. Posted by Ohio Oil Company for the Lima, Ohio, field.
[6] 36°-36.9° gravity oil. 1933 prices from Oil Price Handbook, 1933, p. 164. Posted by Stanolind Oil and Gas C
[7] Grade B (below 25°) gravity oil, 1931 to December 1932; 24°-24.9° gravity oil for December 1932 and 1933 (the
Company.
[8] 30°-30.9° gravity oil in 1931; 27°-27.9° gravity oil in 1932 and 1933 (the change was necessitated by the change i
[9] Postings discontinued.

Prepared by the U. S. Bureau of Mines, Petroleum Economics Division.

V. THE EFFECT OF OVERPRODUCTION IN EAST TEXAS UPON PRICES

1. Average daily production and posted prices, 1931–1933

1931 production figures taken from Department of Commerce, Bureau of Mines, Mineral Resources of the United States, 1931, Part II (Crude petroleum and petroleum products), pp. 565, 566. 1932 pro of Mines, Minerals Yearbook, 1932-1933, Statistical Appendix (Crude petroleum and petroleum products), pp. 308-309. 1933 production figures taken from Department of the Interior, Bureau of M These tables are all reprinted in Appendix B, pp. 110–112, 116–118, 121–123. Where daily average production is not directly given, it is computed by dividing the monthly production by the number of days in

Posted prices for 1931 taken from Department of Commerce, Bureau of Mines, Mineral Resources of the United States, 1931, Part II (Crude petroleum and petroleum products), pp. 608–610. Posted p Mines, Minerals Yearbook, 1932-1933, Statistical Appendix (Crude petroleum and petroleum products), p. 334. These tables are reprinted in Appendix B, pp. 113–115, 119–120. Posted prices for 1933 tak Petroleum News). Bureau of Mines' figures for 1933 have not as yet been published. Prices are given in dollars per barrel.

[Production in thousands of barrels]

	East Texas			Oklahoma City			Mid-Continent except east Texas and Oklahoma City			Appalachian			Lima-Indiana-Illinois			Rocky Mountain			
	Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production
		Date	Amount [1]		Date	Amount [2]		Date	Amount [3]		Date	Amount [4]		Date	Amount [5]		Date	Amount [6]	
1931																			
January	3			82			1,161	Jan. 1	$1.01	81	Jan. 1	$1.80	28	Jan. 1	$1.10	57	Jan. 1	$0.95	17
February	26			98			1,157			83			27			59			17
March	98	Mar. 7	$0.63	140			1,138	Mar. 10	.63	85			26	Mar. 6	.90	56	Mar. 5	.59	16
April	259			172			1,127			82	Apr. 23	1.70	27			58			17
May	315	May 26	.33	177			1,124			78	Apr. 27	1.60	26			56			17
June	363	June 20	.20	193			1,100	June 1	.35	82	June 3	1.35	29			56			17
July	528			154			1,016	July 11	.20	76	July 11	1.20		June 2	.70	57	June 1	.33	15
								July 23	.40		July 29	1.40	30	July 11	.55	53	July 9	.18	14
August	446	Aug. 13	.25	24			922	Aug. 22	.66	74	Aug. 3	1.55	28	July 24	.70		July 24	.38	
		Aug. 22	.68								Aug. 17	1.60		Aug. 18	.85	53	Aug. 22	.62	14
September	360			22			946			89	Aug. 29	1.65		Aug. 24	.90	51			14
October	417			116			1,003			93	Sept. 12	1.80	32			49			14
November	407	Nov. 2	.83	178			1,044	Nov. 2	.81	88	Nov. 1	1.70	33	Nov. 3	1.00	50	Nov. 2	.77	14
December	362			167			1,019			87	Dec. 16	1.55	34			50			14
1932													35			50			14
January	322			121			919			81			34			48			13
February	312			99			945			79			34			49			13
March	343			112			924			80			37			50			13
April	358	Apr. 1	.98	103			970	Apr. 1	.92	85	Apr. 25	1.75	37	Apr. 11	1.15	54	Apr. 11	.92	13
May	345			110			947			86			39			49			14
June	353			95			940			88			38			47			14
July	345			95			928			80			38			49			14
August	334			75			935			83	Aug 11	1.72	39			50			13
September	373			75			920			83	Sept. 13	1.57	42			46			16
October	367	Oct. 14	1.10	68			896	Oct. 15	1.04	76	Oct. 3	1.42	38			44	Oct. 15	1.04	15
November	359			83			890			76			34			44			16
December	173	Dec. 16	.75	73			860	Dec. 15	.88	73			31	Dec. 16	1.00	40	Dec. 15	.88	15
								Dec. 20	.69								Dec. 20	.69	
1933																			
January	351	Jan. 20	.50	109			875	Jan. 18	.44	72	Jan. 19	1.27	32	Jan. 10	.90	41	Jan. 18	.44	16
											Jan. 21	1.17		Jan. 18	.70				
February	387			149			887			71			28			40			16
March	560			200			914			71			29			41			18
April	369	Apr. 25	.10	103			912			71			28			39			19
May	969	May 2 [9]					859	May 6	.25	71	May 9	.97	31	May 9	.55	39	May 7	.25	21
		May 13	.25	134							May 22	1.07							
June	841	June 19	.50	202			929	June 17	.44	74	June 17	1.17	33	June 16	.75	43	June 17	.44	21
											June 26	1.27							
July	646			278			949	July 8	.54	76	July 6	1.37	37	July 5	1.05	40	July 8	.54	23
											July 17	1.52		July 12	.95				
August	608	Aug. 24	.60	268			960	Aug. 25	.64	78	July 28	1.67	47	Aug. 1	.85	41	Aug. 26	.64	23
											Aug. 11	1.77		Aug. 25	.95				
September	560	Sept. 6	.75	223			929	Sept. 6	.74	81	Aug. 30	1.92	50	Sept. 6	1.05	42	Sept. 7	.74	24
		Sept. 8	.90					Sept. 8	.89		Sept. 6	2.02		Sept. 9	1.20		Sept. 9	.89	
		Sept. 29	1.00					Sept. 29	1.00					Sept. 29	1.30		Sept. 29	1.00	
October	525			195			860			83	Oct. 4	2.12	50			40			23
November	453			192			856			78			50			41			23
December	451			188			847			75			46			39			23

[1] 38°–38.9° gravity oil. 1933 prices from Oil Price Handbook, 1933, p. 152. Posted by Humble Oil and Refining Company, the largest purchaser in the field.
[2] Same as Mid-Continent.
[3] 38°–38.9° gravity oil in 1931; 36°–36.9° gravity oil in 1932 and 1933 (the change was necessitated by the change in the basis used by the Bureau of Mines). 1933 prices from Oil Price Handbook, 1933, p.
[4] 1933 prices from Oil Price Handbook, 1933, p. 145. Posted by South West Pennsylvania Pipe Line.
[5] 1933 prices from Oil Price Handbook, 1933, p. 146. Posted by Ohio Oil Company for the Lima, Ohio, field.
[6] 36°–36.9° gravity oil. 1933 prices from Oil Price Handbook, 1933, p. 164. Posted by Stanolind Oil and Gas Company.
[7] Grade B (below 25°) gravity oil, 1931 to December 1932; 24°–24.9° gravity oil for December 1932 and 1933 (the change was necessitated by the change in the basis used by the Bureau of Mines). 1933 pr Company.
[8] 30°–30.9° gravity oil in 1931; 27°–27.9° gravity oil in 1932 and 1933 (the change was necessitated by the change in the basis used by the Bureau of Mines). 1933 prices from Oil Price Handbook, 1933, p
[9] Postings discontinued.

Prepared by the U. S. Bureau of Mines, Petroleum Economics Division.

V. THE EFFECT OF OVERPRODUCTION IN EAST TEXAS UPON PRICES

1. Average daily production and posted prices, 1931–1933

m Department of Commerce, Bureau of Mines, Mineral Resources of the United States, 1931, Part II (Crude petroleum and petroleum products), pp. 565, 566. 1932 production figures taken from Department of Commerce, Bureau -1933, Statistical Appendix (Crude petroleum and petroleum products), pp. 308–309. 1933 production figures taken from Department of the Interior, Bureau of Mines, Annual Petroleum Statement, 1933, No. P. 123, pp. 4–5. ndix B, pp. 110–112, 116–118, 121–123. Where daily average production is not directly given, it is computed by dividing the monthly production by the number of days in the month.
Department of Commerce, Bureau of Mines, Mineral Resources of the United States, 1931, Part II (Crude petroleum and petroleum products), pp. 608–610. Posted prices for 1932 taken from Department of Commerce, Bureau of 3, Statistical Appendix (Crude petroleum and petroleum products), p. 334. These tables are reprinted in Appendix B, pp. 113–115, 119–120. Posted prices for 1933 taken from Oil Price Handbook, 1933 (published by the National s' figures for 1933 have not as yet been published. Prices are given in dollars per barrel.

[Production in thousands of barrels]

Texas		Oklahoma City			Mid-Continent except east Texas and Oklahoma City			Appalachian			Lima-Indiana-Illinois			Rocky Mountain			Gulf Coast			California			Daily average production for total United States
osted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		Daily average production	Posted price		
te	Amount[1]		Date	Amount[2]		Date	Amount[3]		Date	Amount[4]		Date	Amount[5]		Date	Amount[6]		Date	Amount[7]		Date	Amount[8]	
		82			1,161	Jan. 1	$1.01	81	Jan. 1	$1.80	28	Jan. 1	$1.10	57	Jan. 1	$0.95	178	Jan. 1	$0.69	532	Jan. 1	$1.38	2,121
		98			1,157			83			27			59			179			533			2,162
7	$0.63	140			1,138	Mar. 10	.63	85			26	Mar. 6	.90	56	Mar. 5	.59	168			528	Mar. 20 Mar. 31	.68 .35	2,240
		172			1,127			82	Apr. 23	1.70	27												
26	.33	177			1,124			78	Apr. 27	1.60	26			58			177	Apr. 21	.60	527			2,429
20	.20	193			1,100	June 1	.35	82	June 3	1.35	29			56			171			531			2,478
		154			1,016	July 11 July 23	.20 .40	76	July 11 July 29 Aug. 3	1.20 1.40 1.55	30	June 2 July 11 July 24	.70 .55 .70	57 53	June 1 July 9 July 24	.33 .18 .38	155 147	June 3 July 8 July 24	.44 .31 .40	521 519	June 19	.81	2,500 2,523
13 22	.25 .68	24			922	Aug. 22	.66	74	Aug. 17 Aug. 29	1.60 1.65	28	Aug. 18 Aug. 24	.85 .90	53	Aug. 22	.62	141	Aug. 22	.55	505			2,194
		22			946			89	Sept. 12	1.80	32			51			140			506			2,146
		116			1,003			93			33			49			148			505			2,364
2	.83	178			1,044	Nov. 2	.81	88	Nov. 1	1.70	34	Nov. 3	1.00	50	Nov. 2	.77	148	Nov. 2	.70	500			2,449
		167			1,019			87	Dec. 16	1.55	35			50			143			502			2,365
		121			919			81			34			48			134			501			2,162
		99			945			79			34			49			132			504			2,156
		112			924			80			37			50			129			502			2,176
1	.98	103			970	Apr. 1	.92	85	Apr. 25	1.75	37	Apr. 11	1.15	54	Apr. 11	.92	139	Apr. 11	.80	517			2,264
		110			947			86			39			49			142			502			2,221
		95			940			88			38			47			140			471	June 26	1.00	2,171
		95			928			80			38			49			143			472			2,150
		75			935			83	Aug 11	1.72	39			50			152			479			2,147
		75			920			83	Sept. 13	1.57	42			46			166			478			2,184
14	1.10	68			896	Oct. 15	1.04	76	Oct. 3	1.42	38			44	Oct. 15	1.04	156	Oct. 15	.90	472			2,116
		83			890			76			34			44			164			471			2,121
16	.75	73			860	Dec. 15 Dec. 20	.88 .69	73			31	Dec. 16	1.00	40	Dec. 15 Dec. 20	.88 .69	158	Dec. 19	.68	471			1,880
20	.50	109			875	Jan. 18	.44	72	Jan. 19 Jan. 21	1.27 1.17	32	Jan. 10 Jan. 18	.90 .70	41	Jan. 18	.44	161	Jan. 1 Jan. 19	.71 .58	461			2,102
		149			887			71			28			40			163			463			2,188
		200			914			71			29			41			183	Mar. 6	.48	428	Mar. 5	.75	2,425
25	.10	103			912			71			28			39			195			473			2,190
2[9]					859	May 6	.25	71	May 9 May 22	.97 1.07	31	May 9	.55	30	May 7	.25	214	May 3	.30	477			2,795
13 19	.25 .50	134 202			929	June 17	.44	74	June 17 June 26 July 6	1.17 1.27 1.37	33	June 16	.75	43	June 17	.44	216	June 19	.42	476	June 26	.85	2,813
		278			949	July 8	.54	76	July 17 July 28	1.52 1.67	37	July 5 July 12	1.05 .95	40	July 8	.54	239			487			2,752
24	.60	268			960	Aug. 25	.64	78	Aug. 11 Aug 30	1.77 1.92	47	Aug. 1 Aug. 25	.85 .95	41	Aug. 26	.64	253	Aug. 25	.52	502			2,758
6 8 29	.75 .90 1.00	223			929	Sept. 6 Sept. 8 Sept. 29	.74 .89 1.00	81	Sept. 6	2.02	50	Sept. 6 Sept. 9 Sept. 29	1.05 1.20 1.30	42	Sept. 7 Sept. 9 Sept. 29	.74 .89 1.00	240	Sept. 6 Sept. 8 Sept. 29 Sept. 30	.64 .79 .90 .92	486	Sept. 6	1.00	2,611
		195			860			83	Oct. 4	2.12	50			40			231			470			2,454
		192			856			78			50			41			203			461			2,332
		188			847			75			46			39			206			471			2,328

ces from Oil Price Handbook, 1933, p. 152. Posted by Humble Oil and Refining Company, the largest purchaser in the field.

°–36.9° gravity oil in 1932 and 1933 (the change was necessitated by the change in the basis used by the Bureau of Mines). 1933 prices from Oil Price Handbook, 1933, p. 148. Posted by Stanolind Oil and Gas Company.
dbook, 1933, p. 145. Posted by South West Pennsylvania Pipe Line.
dbook, 1933, p. 146. Posted by Ohio Oil Company for the Lima, Ohio, field.
ces from Oil Price Handbook, 1933, p. 164. Posted by Stanolind Oil and Gas Company.
il, 1931 to December 1932; 24°–24.9° gravity oil for December 1932 and 1933 (the change was necessitated by the change in the basis used by the Bureau of Mines). 1933 prices from Oil Price Handbook, 1933, p. 158. Posted by the Texas

°–27.9° gravity oil in 1932 and 1933 (the change was necessitated by the change in the basis used by the Bureau of Mines). 1933 prices from Oil Price Handbook, 1933, p. 165. Posted by Standard Oil Company of California.

f Mines, Petroleum Economics Division.

Production of crude petroleum by districts and States and daily average production in principal fields and States in 1931, by months—Con.

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	Total	Value at wells [1]
Mid-continent:														
Kansas	3,102	3,030	3,299	3,195	3,244	2,999	2,862	2,825	3,105	3,114	3,060	3,183	37,018	25,500
Oklahoma	15,044	14,160	17,088	17,437	18,026	17,683	16,233	9,117	8,414	13,724	16,649	16,999	180,574	119,200
Texas, exclusive of coastal Texas and west Texas	8,789	8,777	11,122	15,645	18,266	18,983	23,955	21,578	19,066	21,317	20,045	18,938	205,881	102,060
West Texas	7,770	6,908	7,304	6,782	6,664	6,465	6,269	6,341	6,048	6,178	5,971	5,824	78,524	37,270
Southeast New Mexico	1,128	1,031	1,198	1,154	1,368	1,229	1,257	1,275	1,238	1,284	1,273	1,269	14,704	6,040
Arkansas	1,535	1,369	1,435	1,378	1,360	1,291	1,140	1,112	1,102	1,094	1,020	955	14,791	7,200
Northern Louisiana	1,246	1,189	1,211	1,140	1,155	1,028	918	897	883	902	845	830	12,244	7,850
Total, Mid-Continent	38,614	35,864	42,657	46,731	50,083	49,678	52,634	43,145	39,856	47,613	48,863	47,998	543,736	305,120
Gulf coast:														
Texas Gulf coast	4,655	4,190	4,421	4,478	4,495	3,979	3,894	3,692	3,512	3,615	3,578	3,523	48,032	31,620
Louisiana Gulf coast	855	817	780	822	813	678	652	693	687	978	867	918	9,560	6,370
Total, Gulf coast	5,510	5,007	5,201	5,300	5,308	4,657	4,546	4,385	4,199	4,593	4,445	4,441	57,592	37,990
ocky Mountain:														
Montana	252	242	255	250	258	249	233	218	242	242	181	208	2,830	2,730
Wyoming	1,325	1,237	1,324	1,331	1,327	1,262	1,236	1,254	1,119	1,102	1,152	1,165	14,834	11,120
Colorado	137	123	134	128	129	138	136	125	112	143	114	126	1,545	825
Northwest New Mexico	48	48	33	41	31	58	42	52	42	45	45	38	523	450
Utah and Alaska				1	1	1	1	1	1	1			7	15
Total, Rocky Mountain	1,762	1,650	1,746	1,751	1,746	1,708	1,648	1,650	1,516	1,533	1,492	1,537	19,739	15,140
California	16,486	14,931	16,365	15,804	16,449	15,641	16,093	15,669	15,181	15,652	14,998	15,561	188,830	135,960
Total, United States: 1931	65,737	60,540	69,429	72,880	76,822	75,011	78,210	68,014	64,378	73,297	73,456	73,327	851,081	550,630
1930	79,633	74,290	78,226	77,483	80,528	77,060	76,922	74,831	71,216	72,893	67,957	66,972	898,011	1,070,200
Total, Ohio	496	447	482	468	461	464	411	372	440	453	400	433	5,327	5,610
Total, Indiana	74	70	61	69	70	78	74	67	70	70	67	70	840	750
Total, Texas	21,214	19,275	22,847	26,905	29,425	29,427	34,118	31,611	28,626	31,110	29,594	28,285	332,437	170,950
Total, Louisiana	2,101	2,006	1,991	1,962	1,968	1,706	1,570	1,590	1,570	1,880	1,712	1,748	21,804	14,220
Total, New Mexico	1,176	1,079	1,231	1,195	1,399	1,287	1,299	1,327	1,280	1,329	1,318	1,307	15,227	6,490

[1] Thousands of dollars.

Production of crude petroleum by districts and States and daily average production in principal fields and States in 1931, by months—Continued

[Thousands of barrels of 42 U. S. gallons]

DAILY AVERAGE PRODUCTION

	January	February	March	April	May	June	July	August	September	October	November	December	Total
California	532	533	528	527	531	521	519	505	506	505	500	502	517
Kettleman Hills	22	27	26	26	39	58	73	63	62	60	60	60	48
Long Beach	93	95	90	88	86	80	78	76	79	76	75	76	83
Santa Fe Springs	72	71	71	72	72	65	63	62	62	61	62	64	66
Kansas	100	108	106	107	105	100	92	91	104	100	102	103	101
New Mexico	38	39	40	40	45	43	42	43	43	43	44	42	42
Hobbs	30	30	32	33	39	36	36	37	36	36	38	37	35
Oklahoma	485	506	551	581	581	589	524	294	280	443	555	548	495
Oklahoma City	82	98	140	172	177	193	154	24	22	116	178	167	127
Seminole	156	145	157	153	152	146	136	75	61	101	151	142	131
Texas	684	688	737	897	949	981	1,101	1,020	954	1,004	987	912	911
East Texas	3	26	98	259	315	363	528	446	360	417	407	362	300
Gulf coast	150	150	143	149	145	133	126	119	117	117	119	114	132
West Texas	251	247	236	226	215	216	202	205	202	199	199	188	215
Wyoming	43	44	43	44	43	42	40	40	37	35	38	38	41
Salt Creek	26	26	26	26	25	25	24	23	23	22	22	22	24
Other States	239	244	235	233	224	224	205	201	222	234	223	220	225
United States: 1931	2,121	2,162	2,240	2,429	2,478	2,500	2,523	2,194	2,146	2,364	2,449	2,365	2,332
1930	2,569	2,653	2,523	2,583	2,598	2,569	2,481	2,414	2,374	2,351	2,265	2,160	2,460

[Pages 608–610]

Average monthly prices per barrel for selected grades of crude petroleum at wells in 1931

	Pennsylvania grade		Oklahoma-Kansas, 34°–34.9°	Gulf-coast grade B	Illinois	Lima, Ohio	Panhandle, Texas (Carson and Hutchinson Counties 35°–35.9°)	California (Long Beach, 30°–30.9°)	West Texas (Crane-Upton, etc., 30°–30.9°)
	Bradford	Southwest Pennsylvania							
January	$2.15	$1.80	$0.89	$0.69	$1.30	$1.10	$0.63	$1.38	$0.62
February	2.15	1.80	.89	.69	1.30	1.10	.57	1.38	.62
March	2.15	1.80	.65	.69	.88	.93	.45	1.10	.43
April	2.11	1.76	.55	.66	.80	.90	.37	.35	.33
May	2.00	1.60	.55	.60	.80	.90	.32	.35	.30
June	1.77	1.37	.31	.45	.56	.71	.23	.53	.25
July	1.67	1.27	.26	.36	.49	.64	.18	.81	.17
August	1.97	1.57	.42	.45	.64	.78	.32	.81	.28
September	2.20	1.75	.58	.55	.80	.90	.43	.81	.35
October	2.20	1.80	.58	.55	.80	.90	.43	.81	.35
November	2.00	1.70	.73	.70	.94	.99	.58	.81	.50
December	1.92	1.62	.73	.70	.95	1.00	.58	.81	.50
	2.02	1.65	5.9	.59	.85	.90	.42	.83	.39

Posted price per barrel of petroleum at wells in 1931, by grades, with dates of change

Date	Pennsylvania grade		Corning grade in Buckeye Pipe Line Co. lines [2]	Western Kentucky [3]	Lima, Ohio [3]	Illinois and Princeton, Ind. [3]	Midland, Mich. [4]
	Bradford and Allegheny districts [1]	In Southwest Pennsylvania Pipe Line Co. lines [2]					
Jan. 1	$2.15	$1.80	$1.15	$1.15	$1.10	$1.30	$1.15
Mar. 6				.75	.90	.80	
Mar. 11			.80				
Mar. 13							
Apr. 23	2.00	1.70					.75
Apr. 27		1.60					
June 1							
June 2							
June 3	1.75	1.35	.65	.50	.70	.55	.52
July 11	1.60	1.20	.50				
July 24				.35	.55	.40	
July 25				.50	.70	.55	.37
July 28	1.80						
July 29							.57
Aug. 3		1.40	.65				
Aug. 17	1.95	1.55					
Aug. 18	2.00	1.60					
Aug. 23							
Aug. 24				.65	.85	.70	
Aug. 29	2.10	1.65		.75	.90	.80	.73
Sept. 1			.70				
Sept. 4			.75				
Sept. 12	2.25	1.80					
Sept. 16			.80				
Oct. 9							
Oct. 15	2.15						.55
Nov. 1	2.00	1.70					
Nov. 3							
Dec. 1				.90	1.00	.95	
Dec. 16	1.85	1.55	.85				
Average for year	2.02	1.65	.82	.78	.90	.85	.73

[1] The Tide Water Pipe Co. (Ltd.)
[2] The Joseph Seep Purchasing Agency.
[3] The Ohio Oil Co.
[4] The Pure Oil Co.

Posted price per barrel of petroleum at wells in 1931, by grades, with dates of change—Continued

Date	Kansas-Oklahoma; north and north-central Texas [5]		Panhandle, Texas (Carson and Hutchinson Counties, 35°-35.9°) [6]	West Texas, 30°-30.9° [6]	Hobbs, N. Mex., 35°-35.9° [6]	Darst, Tex. [6]	Southwest Texas, Mirando [6]
	34°-34.9°	38°-38.9°					
Jan. 1	$0.89	$1.01	$0.72	$0.62	$0.72	$0.90	$0.75
Jan. 14			.57				.69
Jan. 15	[7] .67	[7] .75					
Mar. 10	.55	.63	.40	[8] .35	[8] .40	.60	
Apr. 21			.32	.30	.32½	.53	.60
Apr. 23	[9] .45	[9] .53					
June 1	.31	.35					
June 3			.22	.25	.25	.37	.44
July 8	[9] .16	[9] .20	.12	.10	.10	.20	.35
July 11	[10]	[10]					
July 23	.35	.40					
July 24			[8] .27	.25	.25	.37	.44
Aug. 22	.58	.66	.43	.35	.35	.52	.60
Nov. 2	.73	.81	.58	.50	.50	.60	.75
Average for year	[11]	[12]	.42	.39	.42	.57	.61

Date	Van, Tex., 34°-34.9° [4]	East Texas, 38°-38.9° [13]	Gulf coast			North Louisiana, 34°-34.9° [13]	Smackover, Ark. [15]
			Refugio, below 25° [6]	Grade A [14]	Grade B, below 25° [14]		
Jan. 1	$0.89		$0.75	$0.80	$0.69	$0.89	$0.70
Jan. 14			.69				
Mar. 10	.55					.55	.45
Mar. 27		$0.63					
Apr. 21			.60	.70	.60		
May 26		.33					
June 1	.31						
June 3			.44	[16]	.44	.31	.25
June 20		[9] .20					
July 8			.31		.31		
July 10	.16						
July 11						.16	.15
July 24	.40		.40		.40	.36	.30
Aug. 13		.25					
Aug. 22		.68	.55		.55		
Aug. 24	.58					.58	.45
Nov. 2	.73	.83	.70		.70		
Nov. 4						.73	.55
Average for year	.60	.56	.59		.59	.59	.47

[4] The Pure Oil Co.
[5] The Texas Co.
[6] Humble Oil & Refining Co.
[7] North Texas only.
[8] Gravity scale discontinued.
[9] North and north central Texas only.
[10] Oklahoma-Kansas quoted same as north and north central Texas.
[11] Oklahoma-Kansas, $0.59; north Texas, $0.55; north central Texas, $0.58.
[12] Oklahoma-Kansas, $0.67; north Texas, $0.62; north central Texas, $0.66.
[13] Magnolia Petroleum Co.
[14] Gulf Pipe Line Co.
[15] Standard Oil Co. of Louisiana.
[16] Put on gravity basis with grade B.

Posted price per barrel of petroleum at wells in 1931, by grades, with dates of change—Continued

Date	Salt Creek, Wyo. 36°–36.9° [15]	Sunburst, Mont.[3]	California [17]				
			Kettleman Hills 55° and above	Long Beach, 30°–30.9°	Midway-Sunset, 19°–19.9°	Playa del Rey, 22°–22.9° [19]	Santa Fe Springs, 33°–33.9°
Jan. 1	$0.95	$1.55	$1.65	$1.38	$0.70	$0.81	$1.48
Mar. 5	.59						
Mar. 20			[20]	.68	.55	.56	.68
Mar. 31				.35		[20]	.35
June 1	.33						
June 2		.85					
June 19				.81		.67	.83
July 9	.18						
July 10		.70					
July 24	.38						
July 25		.80					
Aug. 22	.62						
Aug. 24		.90					
Nov. 2	.77						
Nov. 3		1.00					
Average for year	.63	1.17		.83	.58		.86

[3] The Ohio Oil Co.
[17] Standard Oil Co. of California.
[15] The Midwest Refining Co.
[19] Subject to field gathering charge of 5 cents per barrel.
[20] Temporarily discontinued.

b. Department of Commerce, Bureau of Mines, Minerals Yearbook, 1932–33, Statistical Appendix (Crude Petroleum and Petroleum Products):

[Pages 308, 309]

Production of crude petroleum by districts and States and daily average production in principal fields and States in 1932, by months

[Thousands of barrels of 42 U. S. gallons]

TOTAL PRODUCTION

	January	February	March	April	May	June	July	August	September	October	November	December	Total	Value at wells [1]
Appalachian:														
New York	323	294	303	301	313	307	298	304	277	266	259	263	3,508	6,630
Pennsylvania	1,053	972	1,042	1,109	1,136	1,122	1,028	1,055	970	977	964	984	12,412	23,400
West Virginia	333	304	325	347	345	356	318	336	306	323	287	296	3,876	6,050
East and southeast Ohio	296	281	304	316	321	324	289	304	294	288	280	282	3,579	4,230
Kentucky	524	468	518	473	547	535	550	579	648	502	490	453	6,287	5,906
Tennessee	1	-------	-------	1	1	-------	1	-------	1	-------	-------	-------	5	4
Total Appalachian	2,530	2,319	2,492	2,547	2,663	2,644	2,484	2,578	2,496	2,356	2,280	2,278	29,667	46,220
Lima-Indiana:														
Northwestern Ohio	83	81	91	98	99	103	91	94	89	85	72	79	1,065	1,200
Northeastern Indiana	3	2	3	3	3	3	2	2	2	2	2	2	29	18
Michigan	483	423	475	534	592	531	601	644	742	745	594	546	6,910	5,260
Total Lima-Indiana	569	506	569	635	694	637	694	740	833	832	668	627	8,004	3,478
Illinois-Indiana:														
Southwest Indiana	69	70	66	72	73	75	71	71	62	49	50	49	777	810
Illinois	433	415	502	391	450	428	398	407	376	285	299	289	4,673	4,720
Total Illinois-Indiana	502	485	568	463	523	503	469	478	438	334	349	338	5,450	5,530
Mid-Continent:														
Kansas	3,014	2,774	2,932	2,951	2,973	2,774	2,948	3,039	2,960	2,945	2,846	2,692	34,848	31,720
Oklahoma	13,758	12,458	13,361	13,403	13,839	12,936	13,051	12,619	12,051	12,006	11,912	11,850	153,244	137,920
Texas, exclusive of coastal Texas and west Texas	17,170	15,979	17,891	18,124	18,147	17,779	18,029	17,860	18,300	18,396	17,517	12,101	207,293	184,740
West Texas	5,302	5,340	5,624	5,544	5,468	5,245	5,428	5,319	4,970	5,093	4,938	5,064	63,335	40,860

Southeast New Mexico	1,139	1,043	1,119	1,076	1,101	1,031	1,069	948	899	917	912	817	12,062	7,285
Arkansas	1,022	965	1,014	998	1,073	1,002	1,028	1,007	1,001	1,031	975	935	12,051	7,690
Northern Louisiana	833	779	809	846	875	858	867	886	870	863	863	842	10,191	9,170
Missouri	-------	1	1	1	1	1	1	1	1	1	1	-------	10	9
Total Mid-Continent	42,238	39,339	42,751	42,943	43,477	41,626	42,412	41,679	41,052	41,252	39,964	34,301	493,034	419,394
Gulf coast:														
Texas Gulf coast	3,259	3,031	3,108	3,152	3,315	3,284	3,472	3,729	3,975	3,797	3,869	3,859	41,850	34,100
Louisiana Gulf coast	882	784	855	1,018	1,077	924	975	979	992	1,044	1,047	1,039	11,616	9,380
Total Gulf coast	4,141	3,815	3,963	4,170	4,392	4,208	4,447	4,708	4,967	4,841	4,916	4,898	53,466	43,480
Rocky Mountain:														
Montana	171	210	220	239	227	223	229	222	188	189	163	176	2,457	2,560
Wyoming	1,192	1,088	1,176	1,251	1,178	1,059	1,163	1,203	1,067	1,043	1,031	967	13,418	10,942
Colorado	108	104	113	102	100	95	91	84	89	85	84	81	1,136	880
Northwest New Mexico	31	29	28	40	23	29	37	35	36	38	33	34	393	365
Utah and Alaska	-------	-------	-------	1	1	1	1	1	1	-------	-------	-------	6	11
Total Rocky Mountain	1,502	1,431	1,537	1,633	1,529	1,407	1,521	1,545	1,381	1,355	1,311	1,258	17,410	14,758
California	15,532	14,617	15,576	15,524	15,576	14,119	14,628	14,840	14,351	14,628	14,142	14,595	178,128	144,600
Total United States: 1932	67,014	62,512	67,456	67,915	68,854	65,144	66,655	66,568	65,518	65,598	63,630	58,295	785,159	680,460
1931	65,737	60,540	69,429	72,860	76,822	75,011	78,210	68,014	64,378	73,297	73,456	73,327	851,081	550,630
Total Ohio	379	362	395	414	420	427	380	398	383	373	352	361	4,644	5,430
Total Indiana	72	72	69	75	76	78	73	73	64	51	52	51	806	828
Total Texas	25,731	24,350	26,623	26,820	26,930	26,308	26,929	26,908	27,245	27,286	26,324	21,024	312,478	259,700
Total Louisiana	1,715	1,563	1,664	1,864	1,952	1,782	1,842	1,865	1,862	1,907	1,910	1,881	21,807	18,550
Total New Mexico	1,170	1,072	1,147	1,116	1,124	1,060	1,097	983	935	955	945	851	12,455	7,650

[1] Thousands of dollars.

Production of crude petroleum by districts and States and daily average production in principal fields and States in 1932, by months—Continued

[Thousands of barrels of 42 U. S. gallons]

DAILY AVERAGE PRODUCTION

	January	February	March	April	May	June	July	A	September	October	November	December	Total
California	501	504	502	517	502	471	472	479	478	472	471	471	487
Kettleman Hills	60	60	60	60	59	60	61	60	59	59	61	60	60
Long Beach	79	81	83	82	80	72	71	73	71	68	70	70	75
Santa Fe Springs	65	66	66	66	64	60	58	59	59	64	57	56	62
Kansas	97	96	95	98	96	92	95	98	99	95	95	87	95
New Mexico	38	37	37	37	36	35	35	32	31	31	32	27	34
Hobbs	32	31	31	31	30	29	29	25	25	25	25	21	28
Oklahoma	444	430	431	447	446	431	421	407	402	387	397	382	419
Oklahoma City	121	99	112	103	110	95	95	75	75	68	83	73	92
Seminole	126	128	125	124	122	117	117	114	112	109	107	107	117
Texas	830	840	859	894	869	877	869	868	908	880	877	678	854
East Texas	322	312	343	358	345	353	345	334	373	367	359	173	332
Gulf coast	105	105	100	105	107	109	112	120	133	122	129	124	114
West Texas	171	184	181	185	176	175	175	172	166	164	165	163	173
Wyoming	38	38	38	42	38	35	38	39	36	34	34	31	36
Salt Creek	23	22	22	25	22	22	21	21	21	21	21	19	22
Other States	214	211	214	229	234	230	220	224	230	217	215	204	220
United States: 1932	2,162	2,156	2,176	2,264	2,221	2,171	2,150	2,147	2,184	2,116	2,121	1,880	2,145
1931	2,121	2,162	2,240	2,429	2,478	2,500	2,523	2,194	2,146	2,364	2,449	2,365	2,332

[page 334]

Posted price per barrel of petroleum at wells in 1932, by grades, with dates of change

Date	Pennsylvania grade		Corning grade in Buckeye Pipe Line Co. lines [2]	Western Kentucky [3]	Lima, Ohio [3]	Illinois and Princeton, Ind. [3]	Midland, Mich. [4]	Kansas-Oklahoma; north and north-central Texas [5]	
	Bradford and Allegheny districts [1]	In Southwest Pennsylvania Pipe Line Co. lines [2]						34°–34.9°	36°–36.9°
Jan. 1	$1.85	$1.55	$0.85	$0.90	$1.00	$0.95	$0.55	$0.73	$0.77
Mar. 12	1.82								
Apr. 1								.88	.92
Apr. 11				1.05	1.15	1.10			
Apr. 25	2.02	1.75	.95						
May 17							.65		
June 30							.75		
July 13							.85		
Aug. 11									
Sept. 13		1.72	1.05						
Oct. 3	1.87	1.57							
Oct. 15	1.72	1.42	.85						
Dec. 15								1.00	1.04
Dec. 16								.82	.88
Dec. 20				.82	1.00	.87			
Dec. 31								.65	.69
Average for year	1.88	1.59	.96	1.00	1.10	1.05	.95	.85	.89

Date	Panhandle, Texas (Carson and Hutchinson Counties 35°–35.9°) [6]	West Texas [6]	Hobbs, N. Mex. [6]	Darst, Tex. [6]	Southwest Texas, Mirando [6]	Van, Tex., 34°–34.9 [4]	East Texas [7]	Gulf coast	
								Conroe, 38°–38.9° [6]	Grade B, below 25° [8]
Jan. 1	$0.58	$0.50	$0.50	$0.60	$0.75	$0.73	$0.83		
Apr. 1							.98		$0.70
Apr. 11	.68	.65	.65	.75	.80	.88			.80
July 18							1.10	[9] $0.96	
Oct. 14						1.00			.90
Oct. 15					.70				
Nov. 21	.53	.50	.50	.60	.55	.65		.86	
Dec. 15							.75		[10] .68
Dec. 16									
Dec. 19									
Average for year	.65	.60	.60	.70	.77	.85	.95	.95	.79

See footnotes at end of table.

Posted price per barrel of petroleum at wells in 1932, by grades, with dates of change—Continued

Date	North Louisiana, 34°–34.9° [11]	Smackover, Ark.[11]	Salt Creek, Wyo., 36°–36.9° [12]	Sunburst, Mont.[3]	California [13]				
					Kettleman Hills, 38°–38.9°	Long Beach, 27°–27.9°	Midway-Sunset, 19°–19.9°	Playa del Rey, 22°–22.9°	Santa Fe Springs, 33°–33.9°
Jan. 1	$0.73	$0.55	$0.77	$1.00	.....	$0.75	$0.55	$0.67	$0.83
Apr. 11	.88	.65	.92	1.05	.....	.....	.....	.....	.....
June 26	.....	.....	.....	.....	[9] $1.01	1.00	.....	.78	1.14
Oct. 15	.....	.....	1.04	.....	.....	.....	.....	.....	.....
Nov. 7	.....	.....	.....	.75	.....	.....	.....	.....	.....
Dec. 15	.....	.....	.88	.....	.....	.....	.....	.....	.....
Dec. 16	[14] .59	.30	.....	.....	.....	.....	.....	.....	.....
Dec. 20	.....	.....	.69	.....	.....	.....	.....	.....	.....
Average for year	.83	.61	.89	.99	1.01	.88	.55	.73	.99

[1] The Tide-Water Pipe Co., Ltd.
[2] The Joseph Seep Purchasing Agency.
[3] The Ohio Oil Co.
[4] The Pure Oil Co.
[5] The Texas Co.
[6] Humble Oil & Refining Co.
[7] Magnolia Petroleum Co
[8] Gulf Pipe Line Co.
[9] First posting.
[10] 24°–24.9°.
[11] Standard Oil Co. of Louisiana.
[12] The Midwest Refining Co.; Stanolind Oil & Gas Co., after Nov. 12.
[13] Standard Oil Co. of California.
[14] Caddo, 34°–34.9°.

c. Department of the Interior, United States Bureau of Mines, Annual Petroleum Statement, 1933, No. P. 123, pp. 4–5.

Production of crude petroleum in 1933, by States

[Thousands of barrels of 42 U. S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	1933	1932
Arkansas	974	844	974	960	979	1,040	1,011	959	1,077	1,015	915	938	11,686	12,051
California	14,285	12,955	13,267	14,187	14,781	14,276	15,094	15,556	14,574	14,585	13,839	14,611	[1] 172,010	178,128
Huntington Beach	787	705	630	822	901	919	1,152	1,485	1,161	1,288	1,690	1,434	12,974	8,016
Kettleman Hills	1,796	1,610	1,850	1,797	1,932	1,854	1,970	1,936	1,899	1,871	1,468	1,656	21,639	21,960
Long Beach	2,021	1,867	1,820	2,196	2,263	2,210	2,301	2,340	1,966	1,805	1,713	1,893	24,395	27,436
Santa Fe Springs	1,683	1,471	1,504	1,614	1,667	1,616	1,669	1,662	1,482	1,420	1,139	1,302	18,229	22,538
Rest of State	7,998	7,302	7,463	7,758	8,018	7,677	8,002	8,133	8,066	8,201	6,829	8,326	94,773	98,178
Colorado	85	71	85	69	82	75	81	75	70	74	77	75	919	1,136
Illinois	297	262	316	284	314	359	409	413	415	408	389	378	4,244	4,673
Indiana	49	46	52	50	51	62	68	70	71	75	73	70	737	806
Kansas	2,932	2,919	3,611	3,527	3,280	3,453	4,061	3,909	3,831	3,307	3,666	3,480	41,976	34,848
Kentucky	438	336	379	351	362	320	428	382	414	423	389	386	4,608	6,287
Louisiana	1,993	1,703	2,080	2,153	2,084	1,982	2,131	2,299	2,141	2,210	2,213	2,179	25,168	21,807
Gulf coast	1,074	935	1,146	1,253	1,253	1,222	1,346	1,448	1,373	1,438	1,444	1,374	15,306	11,616
Rest of State	919	768	934	900	831	760	785	851	768	772	769	805	9,862	10,191
Michigan	546	407	439	442	524	488	563	879	905	962	895	892	7,942	6,910
Montana	166	142	165	169	184	207	205	199	203	210	218	205	2,273	2,457
New Mexico	994	1,019	1,170	1,087	1,094	1,146	1,268	1,265	1,249	1,289	1,263	1,272	14,116	12,455
New York	254	240	272	245	223	256	256	280	286	292	279	298	3,181	3,508
Ohio	352	315	353	339	338	338	362	394	370	395	346	333	4,235	4,644
Cent. & Eastern	266	246	269	260	256	250	267	295	275	299	266	254	3,203	3,579
Northwestern	86	69	84	79	82	88	95	99	95	96	80	79	1,032	1,065
Oklahoma	12,955	12,774	15,669	11,957	13,243	15,545	18,813	19,043	16,607	15,479	14,936	15,230	182,251	153,244
Oklahoma City	3,379	4,164	6,207	3,102	4,144	6,063	8,620	8,320	6,689	6,029	5,749	5,846	68,312	33,807
Seminole	3,661	3,040	3,419	3,062	3,105	3,423	4,048	4,113	3,753	3,237	3,268	3,303	41,432	42,911
Rest of State	5,915	5,570	6,043	5,793	5,994	6,059	6,145	6,610	6,165	6,213	5,919	6,081	72,507	76,526
Pennsylvania	972	900	1,004	993	1,045	1,061	1,080	1,113	1,108	1,188	1,086	1,074	12,624	12,412

[1] Central Committee of California Oil Producers.

Production of crude petroleum in 1933, by States—Continued

[Thousands of barrels of 42 U.S. gallons]

	January	February	March	April	May	June	July	August	September	October	November	December	1933	1932
Texas	26,557	25,183	34,080	27,697	46,815	42,504	38,231	37,325	33,702	32,860	28,156	29,499	402,609	312,478
Gulf coast	3,924	3,632	4,523	4,594	5,383	5,252	6,077	6,386	5,839	5,719	4,645	5,028	61,002	41,850
West Texas	4,959	4,408	4,991	4,963	5,003	4,875	4,966	5,122	4,257	4,177	3,697	3,926	55,344	63,335
East Texas	10,877	10,839	17,363	11,078	30,039	25,225	20,027	18,845	16,800	16,287	13,602	13,972	204,954	121,449
Panhandle	1,419	1,243	1,480	1,390	1,339	1,455	1,528	1,546	1,404	1,401	1,203	1,265	16,673	18,263
Rest of State	5,378	5,061	5,723	5,672	5,051	5,697	5,633	5,426	5,402	5,276	5,009	5,308	64,636	67,581
West Virginia	302	262	281	287	313	317	323	357	339	373	335	326	3,815	3,876
Wyoming	1,005	872	985	909	923	954	934	964	956	929	888	908	11,227	13,418
Other	3	2	3	3	3	3	3	3	3	3	3	3	[2] 35	[3] 21
Total United States	65,159	61,252	75,185	65,709	86,638	84,386	85,321	85,485	78,321	76,077	69,966	72,157	905,656	785,159
Daily average	2,102	2,188	2,425	2,190	2,795	2,813	2,752	2,758	2,611	2,454	2,332	2,328	2,481	2,145

[2] Alaska, Mississippi, Missouri, Tennessee, and Utah.
[3] Alaska, Missouri, Tennessee, and Utah.

Production and indicated domestic demand of crude petroleum in the United States, in 1933, by fields of origin

[Thousands of barrels of 42 U. S. gallons]

Production	January	February	March	April	May	June	July	August	September	October	November	December	1933	1932
Appalachian:														
Pennsylvania grade	1,655	1,519	1,681	1,652	1,705	1,762	1,793	1,899	1,870	2,006	1,833	1,822	21,197	21,520
Other (inc. Kentucky)	578	465	525	484	494	442	561	529	552	570	523	516	6,239	8,147
Lima-NE. Indiana-Michigan	633	477	524	522	607	577	660	980	1,001	1,059	976	972	8,988	8,004
Illinois-SW. Indiana	345	307	367	333	364	420	475	481	485	482	461	447	4,967	5,450
Mid-continent:														
N. Louisiana and Arkansas	1,894	1,613	1,909	1,861	1,811	1,800	1,796	1,810	1,846	1,787	1,684	1,744	21,555	22,242
West Texas & SE. New Mexico	5,934	5,406	6,131	6,020	6,075	5,981	6,198	6,351	5,474	5,437	4,917	5,168	69,092	75,397
Other (Okla., Kans., N. Tex., etc.)	33,562	32,837	43,847	33,625	52,952	51,376	50,063	48,769	44,045	41,751	38,417	39,256	510,500	395,395
Gulf coast	4,998	4,567	5,669	5,847	6,636	6,474	7,423	7,834	7,212	7,157	6,089	6,402	76,308	53,466
Rocky Mountain [1]	1,275	1,106	1,265	1,178	1,213	1,278	1,258	1,276	1,262	1,243	1,227	1,219	14,800	17,410
California	14,285	12,955	13,267	14,187	14,781	14,276	15,094	15,556	14,574	14,585	13,839	14,611	172,010	178,128
Total	65,159	61,252	75,185	65,709	86,638	84,386	85,321	85,485	78,321	76,077	69,966	72,157	905,656	785,159

[1] Includes Alaska.

2. Oil Weekly, May 15, 1933.—*Price Cuts Extend to Mid-Continent-Eastern Areas:*

[Page 33]

Crude-oil price readjustments which started in the East Texas field April 24 continued into the past week, having extended not only throughout Texas, New Mexico, Louisiana, and Arkansas, but also over Oklahoma and Kansas, and into Illinois, Indiana, Kentucky, and Ohio, as well as Michigan and the Eastern States. In all those areas crude oil is now sold at flat prices, which, in some instances, are only half of former postings, with gravity scales almost completely discontinued.

An important feature of the crude-price situation during the past week was further readjustment of the East Texas market structure, with additional major purchasers falling in line with the 25 cents per barrel posting for East Texas crude. By the middle of the week the 10-cent postings for that area, inaugurated April 24 by The Texas Company, had been completely abandoned, and the 25-cent level set up by Magnolia Petroleum Company April 26 was the generally accepted posted price, although Humble Oil & Refining Company continued paying what it terms the "going price" instead of using a posting.

EAST TEXAS SPOT MARKET WEAKENS

While there was general stabilization of the posted price for East Texas crude at 25 cents per barrel, there developed during the week, nevertheless, a tendency toward weakness, with the spot market declining appreciably. For although the

price stood near the 25-cent level of official postings throughout the early part of the week, a price range of 17½ to 22½ cents per barrel developed on spot crude in the big field later in the week. That sag in the price began when the railroad commission announced May 10 that its existing rule would be continued to May 17.

Continuation of the order automatically assures an abundant supply of spot oil in East Texas another 10 days or more, as the 800,000-barrel daily allowable for the field is being stretched to about 1,000,000 barrels through overproduction of wells.

Because of the sustained high rate of production many purchasers will be forced to reduce their takings regardless of the price, having approached the saturation point on storage at tidewater points or being unable to continue rapid turnover on sales to plants on the Atlantic coast and in Europe. Any appreciable cut in purchases will promptly force the spot prices to lower levels.

GASOLINE CHEAP IN EAST TEXAS

Along with the unsettling of the crude oil market there was further weakening of the refined oil market in the big flush field, gasoline prices quoted at the end of the week by East Texas plants having hit a new low for some weeks at 1⅞ cents per gallon for U. S. motor grade, with indications that the bottom had not yet been reached. All plants are operating near maximum capacity or to the limit of their ability to move refined oils as manufactured. Crude oil for use in the plants is, of course, extremely plentiful. A drop of two cents per gallon in retail prices of Standard Oil Company (Indi-

ana) during the week temporarily blocked gasoline sales into that Company's trade territory by East Texas plant owners until the latter began lowering their quotations.

NORTH TEXAS CRUDE SUPPLY SCARCE

In contrast with the softening of the East Texas crude oil market during the latter part of the past week, the supply of crude in North Texas became somewhat scarce with the 25-cent Mid-Continent flat price posting in effect, and in consequence premiums ranging from five to 10 cents per barrel were quoted by three independent refining companies. Olney Oil & Refining Company, LaSalle Petroleum Company, and Panhandle Refining Company were the concerns which raised their price offers above the official posted scale when they could not otherwise fulfill their requirements.

Those premium offers are reported to have forestalled shutting in of some pumping wells in the district because of the 25-cent price not being commensurate with lifting costs. King Royalty Company, one of the largest independent producers in the district, halted pumping operations on 44 of its leases, involving about 1,500 barrels settled production daily from 375 wells. In the Red River bed district, forming the Oklahoma-Texas border, about 700 barrels of settled production was withheld from the market furnished by Bell Oil & Gas Company when the price broke to 25 cents a barrel.

OKLAHOMA-KANSAS PRICES CUT

Although Oklahoma and Kansas had temporarily escaped the price cutting by which North

and Central Texas and other Mid-Continent high-gravity crudes were taken off gravity schedules and leveled to a flat price of 25 cents a barrel, those states shared a similar fate when most major purchasers adopted that new price in accordance with action taken by Stanolind Crude Oil Purchasing Company May 6. Meanwhile there was also general adoption of the 25-cent flat price for North Louisiana and Arkansas crudes, that posting for those states having been initiated May 3 by The Texas Company.

An exception to the new flat price posting of 25 cents generally adopted by buyers of Oklahoma and Kansas crudes was the schedule announced by Magnolia Petroleum Company for Oklahoma crude effective May 9, involving abandonment of its former gravity scale prices and substitution of a new special gravity schedule which placed heavier oils on lower price levels than the new 25-cent posting just adopted by other purchasers. In that new schedule of Magnolia Petroleum Company, Oklahoma crudes below 28 gravity were priced at 20 cents per barrel, those ranging from 28 to 34.9 gravity were priced at 23 cents, and crudes of 35 gravity or higher were listed at 25 cents.

Differences in postings of various purchasers of North Louisiana and Arkansas crudes were wiped out in new postings generally adopting the flat price of 25 cents per barrel which applies to other Mid-Continent crudes.

Greater uniformity in prices paid for Smackover, Arkansas, crude also grew out of the new postings, all purchasers adopting a flat price of 20 cents a barrel except Louisiana Oil Refining Cor-

poration, which retained its 25-cent posting for that field, although meeting the 25-cent flat price for North Louisiana crudes May 6, with exception of Urania oil, which was cut 10 cents to a new price of 15 cents. The company is the only buyer of Urania crude.

MID-WESTERN STATES

The spread of the price cutting into Mid-Western states started May 8, when Ohio Oil Company reduced Wooster crude from 70 cents to 50 cents per barrel at the wells, and on the following day the same company placed in effect reductions of 15 cents per barrel for oils from other fields of that region, cutting Lima crude to 55 cents per barrel, Indiana crude to 25 cents, Illinois and Princeton crudes to 47 cents, and Western Kentucky crude to 42 cents.

Effective May 8, the posted field price of Central Michigan crude oil was cut from 95 cents to 75 cents per barrel, Pure Oil Company initiating the reduction, but similar reductions being posted immediately afterward by all other pipe-line companies. Producers Pipe Line Company made a 20-cent reduction, as did the other companies, but is paying 80 cents per barrel, having previously maintained a posting of $1 per barrel while other purchasers were paying 95 cents. No change in the Muskegon posted price of $1 per barrel was announced.

EASTERN STATES REDUCTIONS

In the Eastern States prices were reduced 20 cents per barrel effective May 9, when The Joseph Seep Purchasing Agency announced new postings.

On the new schedule Pennsylvania grade oil in South West Pennsylvania Pipe Line System is priced at 97 cents per barrel, in Eureka Pipe Line Company system 92 cents, and in Buckeye Pipe Line Company 77 cents; while Corning grade in Buckeye Pipe Line Company system is now 50 cents a barrel.

Tide-Water Pipe Company, quotations effective May 9 list Pennsylvania grade oil in New York Transit Company lines and Bradford district oil in National Transit Company system at $1.27, as against $1.47 formerly.

3. National Petroleum News, May 10, 1933.—*Crude Prices Drop Under Pressure of East Texas Situation:*

[Page 15]

The topheavy situation created by the current production of more than 1,000,000 barrels of crude per day from east Texas has brought crude prices down throughout the midcontinent, in Pennsylvania, and in Central States fields.

Retail gasoline prices also were cut in amounts up to 3 cents per gallon throughout the marketing territory of Standard Oil Co. of Indiana. The cut came May 8, just a few days after President E. G. Seubert gave out a statement saying that conditions appeared to be reaching a point where the industry would have to speak its piece with prices.

Stanolind Oil & Gas Co. (Standard of Indiana subsidiary) also led the way May 6 in spreading the Texas crude cuts into Oklahoma and Kansas. A price of 25 cents was posted on all grades. Other

companies followed quickly. Oil is oil and oil is "two bits" in the midcontinent now. Gravity doesn't matter.

On May 6 Standard of Louisiana extended the cut to Louisiana-Arkansas fields. May 8 Wooster, Ohio, crude was cut 20 cents by Ohio Oil Co. and on May 9 other Central States crudes were cut 15 cents when Pennsylvania dropped 20 cents.

East Texas crude prices firmed up around the 25-cent level at the close of the past week, with only Atlas Pipe Line Co., Sun Oil Co., and The Texas Co., among the large purchasers, still paying 10 cents. Gulf Production Co. and Humble Oil & Refining Co. had withdrawn postings while Sinclair-Prairie led off with an advance from a price of 10 cents to 25 cents per barrel followed by other large buyers. Magnolia Petroleum Co. had never cut below 25 cents.

Results of the cut on production levels in Oklahoma began to be seen May 8. Following a meeting of Oklahoma City producers that day, 26 operators pledged themselves to withhold from the market, production from the 218 wells they own until the price reaches the point where it is profitable. The largest of these were the Anderson-Prichard Oil Corporation and the T. B. Slick interests.

Some others who did not formally put themselves on record are following the same course and pipe-line runs from the field were falling off rapidly. Most of the operators will continue to take their allowable production until tankage is full.

Kansas Corporation Commission, May 8, decided after a conference with Governor Landon, that the

proposed order shutting in State fields would not be issued, but producers in prorated areas were assured that if they elected to shut in they could produce later the amount of oil due them in May.

Chairman Hoch said the Governor had talked to Governor Murray, who said he had no intention of trying to shut in Oklahoma fields at this time pending developments in Washington.

Meantime east Texas continues to reach higher levels of output. The 24-hour period ended Sunday morning, May 7, was the record for the field to date. Movement by pipe line, tank car, and to local refineries totaled 979,600 barrels. In addition there were 843 wells from which production was not sold, but nearly all of which were producing some amount of oil. The total for the field was estimated to be more than 1,200,000 barrels.

The movement for May 8 was 913,300 barrels, but the number of wells refusing to sell oil had dropped to 642. At one time more than 1,100 wells were withholding production from the market, but the general posting of 25 cents is bringing them back into the market.

Explaining the drastic cuts in retail gasoline prices, President Seubert, of Standard of Indiana, said that overproduction has brought about a chaotic condition in the gasoline market so that gasoline is selling below cost at hundreds of points.

In the past, he said, the company has tried to meet local situations as they arose, but "cut-throat" competition has become so general "that we are obliged to recognize it as effective throughout our territory and act accordingly."

The effort of the company has been, in the new postings, to level out the territory on a new basis

roughly 3 cents below the old "normal" price level. Advances were made at some points.

4. Oil and Gas Journal, January 25, 1934.—Smiley, *All Records Smashed in 1933, When Motorist Paid Only 12.76 Cents for His Motor Fuel:*

[Page 42]

All-time records were splintered in 1933, when motorists in the United States paid an average of only 12.76 cents a gallon for their gasoline, according to figures based on service-station prices which prevailed throughout the year in 50 representative cities. Whatever they paid in addition to this was not for gasoline. It was for taxes, which ranged from 3 cents in a few—extremely few—areas to 8 cents gleaned from the consumer in several States.

This average service-station price in 1933, exclusive of taxes, compares with 13.30 cents paid in the same 50 cities in 1932. The degree to which the automobile owner benefited from prices brought about not only by advances in refining methods but by a delirious market in which business considerations were flung to the winds is revealed by contrasting the 12.76 cents paid in 1933 with the 19.10 cents paid in 1924, the 19.92 cents in 1925, and 20.92 cents in 1926. This takes no account of the vastly improved quality of motor fuel and the revolutionized filling-station service.

The year 1933, like its successor, opened with a falling gasoline market, and beginning with February new all-time lows were recorded. Up to that time June and September 1931 reflecting extremely cheap crude, had owned the distinction of the lowest 50-city net average price for gasoline, 12.21

cents having been the record for each of these months.

February 1, 1933, with its net average of 11.63 cents, spoiled that record, only to be shoved into the background itself by the March 1 net of 11.49 cents. A feeble effort at recovery ensued, but the best it could do was to register 11.58 cents as the 50-city average on April 1 and 11.60 cents on May 1. Then came a resumption of the retreat. May closed with a net of 11.1 cents and reductions in the Rocky Mountain district on the first day of June brought the average down to the new all-time low of 10.82 cents on that date. Motorists in Wichita, Kans., for instance, were filling their tanks at 7.1 cents a gallon net. Those in Kansas City, Mo., were paying 8.2 cents.

A glance at the accompanying table shows how in each of the first eight months of the year the 50-city price average in 1933 fell below that of the corresponding month in 1932. Beginning with a difference of one-third of a cent in January, the spread grew until there was a gap of 2.86 cents between the average net of 13.68 cents on June 1, 1932, and the 10.82 cents on June 1, 1933. Then the trend was reversed, until September 1, 1933, recorded an average net of 14 cents, as compared with 13.65 cents on the same date in 1932. Higher averages continued to the close of the year, when 14.3 cents net compared with 12.54 at the close of 1932.

Conditions similar to those which in 1931 dragged the prices of oil and its products to what were then the lowest levels since the World War were responsible for the debacle in gasoline prices in the first half of 1933. Proration programs of various kinds

put into effect in 1932 bolstered crude prices so that in the Mid-Continent territory the average for the year was 35 percent higher than in 1931. Gasoline prices experienced a slight bulge in sympathy with the upward movement in crude. But this brightening aspect faded in the latter part of the year when evidence accumulated that proration was not accomplishing what had been expected of it, largely because of defective enforcement.

Price cutting in both crude and its products was added to the evils which beset the refining and marketing divisions of the oil industry in 1932, and after a peak of 14.21 cents in the 50-city average had been reached July 1 a gradual recession set in. Producers seeking quick disposition of their oil sold it below posted prices, and enough of this underpriced oil was thrown on the market to depress the prices of gasoline.

This unhealthy condition of the gasoline market was carried over into 1933. Mid-Continent crude, 36 gravity, began the year with a posted price of 69 cents at the well, but in early May it dropped to 25 cents, and it stayed there till mid-June, when it got back to 44 cents. East Texas crude was obtainable for a time at 10 cents a barrel.

Overproduction of both crude oil and gasoline, along with price cutting and other ruinous practices, had the inevitable effect of wrecking the gasoline market. A dismal outlook confronted refiners and marketers at the beginning of June. A flood of cheap motor fuel from East Texas was finding outlets in the Middle West and the Southeast, and refiners in other districts were compelled to compete with it. The result was that in some areas

gasoline prices were declining in the period of maximum consumption.

5. Oil and Gas Journal, Jan. 25, 1934.—Ziegenhain, *Although 1933 Ended with Higher Refined Prices, Year Worst in Industry's History:*

[Page 40]

The speedy recovery of refined oil prices during the last half of 1933 from the lowest level reached in the history of the industry provides an optimistic atmosphere with which to usher in the new year, but this improvement was not enough to keep 1933 from being marked the "worst ever."

After passing through 2 years of abnormally low refined-oil prices, students of the market felt that a turn would need to come in 1933. As the year progressed, however, there was an ever-increasing flow of crude oil from the east Texas field which could not find an outlet in the normal channels. Producers in the east Texas field sought outlets of one kind or another, and that oil found its way to the refineries in the Chicago area, throughout the midcontinent, the Atlantic coast, and great volumes of it were transported to the Gulf coast to be refined there and abroad. The only important refining area which was not reached directly by east Texas crude was California, but even there the local gasoline market had to absorb several cargoes of east Texas gasoline shipped all that distance through Gulf coast terminals.

The growth of refining activities abroad as a result of foreign purchases of cheap east Texas oil also helped to stifle the California export market, so it may be said that not a single area escaped the

destructive influence of overproduction in east Texas.

It becomes apparent then that the review of the trend of refined-oil prices during the year becomes somewhat of a summary of the control of production in east Texas. With this true, more attention will be given here to that subject than would ordinarily appear in a refined-oil market study. Those who followed crude-oil price changes throughout 1933 will remember the posting of 25 cents for 36 gravity crude on May 5, a drop of 45 cents a barrel from the 69-cent price at which crude of this grade was selling on the first day of the year. This price was maintained for 45 days and during that time oil sold in east Texas for as low as 8 cents a barrel. In May, records show that for one week approximately 3,000,000 barrels of crude were produced daily while domestic refineries were processing but 2,400,000 barrels. Producers in the east Texas area saw signs of water encroachment and they seemed to dedicate their lives to recovering the oil from under their lands regardless of ultimate return. There were many of them who built small plants in the field and by the end of the year there were 53 such plants there. Those plants which were built simply as an outlet for producers of so much crude will probably be abandoned as pipe lines seek the oil. It appears we are entering that period now.

GASOLINE PRICES

Those plants which were built simply to process crude which could not be sold otherwise caused gasoline and fuel-oil prices in the midcontinent and Gulf coast to reach ridiculously low levels and, of

course, the Atlantic coast and California refinery markets, together with those of the Chicago and western Pennsylvania areas suffered also.

United States motor gasoline sold as low as 1⅞ cents in Oklahoma in April and May and much gasoline below 60 octane left Gulf coast terminals at 3 cents, a price unheard of in export circles before this mad scramble to convert crude oil into cash.

FUEL OIL

While this was in progress, fuel-oil prices sank to an equally ridiculous level. Oklahoma refiners received but 27½ cents a barrel for 16-gravity oil and in east Texas refiners were offering it for 5 cents a barrel if a guarantee was made to remove it consistently. Large earthen reservoirs were dug to hold the fuel which was accumulating in the east Texas field. Bunker C oil went to 70 cents a barrel in the New York Harbor.

NATURAL GASOLINE

Although natural gasoline is not a direct product of crude oil, it did not escape the demoralized oil market. In June, 27–70 natural gasoline sold for 1 cent a gallon in Oklahoma. Remembering this fact and then finding that on July 1 the price was 3 cents and on October 1 was 5 cents, it becomes quite evident that forceful and effective influences must have come into the picture. This price advance was more pronounced than in other products but clearly portrays the ability of prices to respond to the program of control established under the oil code. In the months which immediately followed the adoption of the oil code and recognition

of Secretary Ickes as the one controlling agent in the matter of crude production, refinery operations, and the storing of crude and refined products, prices were advanced along the entire front. From June 1 to the middle of September, low octane United States motor gasoline advanced from 2 cents a gallon to 5 cents and other products showed similar gains.

Approximately 250,000 barrels were cut off the daily production of crude within that time and gasoline stocks were reduced about 5,000,000 barrels. In the months which followed plans were formulated by the Planning and Coordination Committee under Administrator Ickes for the complete control of gasoline production, gasoline stocks, and, of course, a definite limit was also placed upon the production and storing of crude by allotting quotas to the individual States.

SHARP PRICE ADVANCE

The plan was received enthusiastically, and as the plans went into operation prices began to rise very quickly. On September 29, 36 gravity mid-continent crude was posted at $1, a compromise price between the $1.10 which the proponents of "price fixing" said was necessary to yield a fair return to the producer for his crude and the 89-cent price which was then in effect. On October 4, Pennsylvania grade crude in National Transit lines was posted at $2.45, a new high for the year, and 25 gravity Signal Hill California crude went to 94 cents a barrel. Throughout this period in the year crude production showed a decline weekly. Optimism in the refinery markets was at its highest.

VI. EFFECT OF OVERPRODUCTION IN EAST TEXAS UPON OIL FIELDS THROUGHOUT THE COUNTRY

1. Statements during Hearings on the National Industrial Recovery Act before the Senate Committee on Finance, Seventy-third Congress, First Session (S. 1712, H. R. 5755):

RUSSELL B. BROWN, INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA

[Page 174]

Attempts to meet this situation have been made by various oil-producing states. Attempts have been made to correlate the limitation regulations of the various states. Such attempts have failed. It is only natural that a state having large flush areas should desire the largest possible production. Any suggestion that one state should limit the production in order that oil fields in another state might have a fair opportunity in the market has been unsuccessful. A suicidal production race has resulted. New fields, with lowest production costs have taken the market from other fields, until still newer fields have entered this race.

The inevitable followed. Excessive quantities of petroleum have been spasmodically produced. The price in a glutted market naturally fell. It is today so low that oil from some of the newer fields can be bought far below the production cost of the older fields. If this continues, older wells of settled production must suspend operations, since they cannot continue at a constant loss. This involves a staggering loss to the entire Nation. There are over 300,000 of these older wells. The oil reserves they touch are greater than the expected produc-

tion from the newer fields with which they are forced to compete. Viewing the situation solely from the standpoint of conservation of an irreplaceable national resource, the abandonment of flush areas would mean less of a loss to the Nation than the abandonment of these 300,000 wells. Furthermore, the flush areas themselves will not long be free producing. It was stated recently at a hearing in Texas that the great east Texas field would soon go on the pump. Because of the open production from the 10,000 wells in this field, such damage has been done that it is now expected that only about 1,140,000,000 barrels of oil will be ultimately recovered out of the expected 1,800,000,000 barrels. This represents a tremendous loss, not only to the various owners of the field or to the oil industry but to the American people.

Situations like this cannot be met by any system or set of rules or regulations which might apply to a factory industry. It cannot even be met by a system which might have application to other natural resources. Special provisions must be made for determination of the market demand for petroleum, for the definite allocation of that demand to the oil-producing States and the equitable distribution of a State's quota among various fields, pools, and common sources of oil within a State. Furthermore, care must be taken in the interest of conservation of this national resource, so important in our economic life, to prevent the premature abandonment of wells of settled production. This involves the establishment of a minimum price not less than the average operating cost of such wells. Equally important is the establishment of a maxi-

mum price in order to prevent the exploitation of the consuming public.

JOSEPH S. BRIDWELL, PRESIDENT OF THE NORTH TEXAS OIL & GAS ASSOCIATION

[Page 177]

I appear before your honorable committee as a citizen of Texas, an independent oil producer in north Texas, east Texas, and Oklahoma, and as president of the North Texas Oil & Gas Association, which has gone on record as favoring Government control, and representative of the Oklahoma Stripper Well Association and the Kansas Stripper Well Association.

The north Texas district, comprising some 15,000 wells, was originally discovered about 1904 and has gradually developed to its present total of about 15,000 wells, which naturally makes oil a principal resource of that district. The present chaotic condition in the oil industry is occasioned by the excessive production in Texas, where there is a market for approximately 800,000 barrels of oil and where there is now a production of more than 1,500,000 barrels, causing a surplus of more than 700,000 barrels, which has demoralized the market to the extent that we are now only receiving 25 cents per barrel for our oil. The north Texas district is producing approximately 3 barrels per well, or a total of 46,000 barrels from approximately 15,000 wells, which necessarily, with the present price, means the absolute abandonment of most of the wells in this district unless action is taken by Congress.

* * * * *

98810—34——10

The present chaotic condition has compelled a great reduction in salaries in the oil field in our district during the last 30 days, as we are dependent upon the revenues from this oil to take care of our operating expenses. If the present condition prevails, thousands of wells will be plugged and thousands of men will necessarily be laid off and be without employment. This alone with the waste that naturally would result from the plugging of these wells is certainly reason enough for Congress to take a definite hand in regulating the production of America to the market requirement.

W. W. WARNER, PRESIDENT OF THE OKLAHOMA STRIPPER WELLS ASSOCIATION

[Page 178]

The stripper wells of the Nation, which constitute one of our most valuable natural resources, must close unless there is some positive certainty that the present condition in the industry will be so remedied that they can operate profitably. * * *

In behalf of the Oklahoma Stripper Well Association, of which I am president, and of like associations of stripper-well owners in Kansas and Texas who join with us for this purpose, I urge that the demoralized petroleum industry be given its chance to recover under the carefully drawn and definite provisions of the Federal oil-control bill, rather than under some general plan which may be ideal for other industries, but which does not consider the unique problems of the production, processing, transportation, and distribution of petroleum products.

The stripper wells are the older wells of the industry. Some of them are 50 years old. They have

been called "the backbone of the industry." The present flush wells will be the stripper wells of the future. Abandonment of these wells will mean the complete loss of one of the Nation's most valuable sources of wealth. That abandonment will be prevented by the Federal oil-control bill. * * *

[Page 180]

Resolution of stripper-well conference (Presented by Mr. Warner):

Whereas the delegates to the stripper-well conference, composed of representatives of oil and gas associations from the States of Kansas, Texas, and Oklahoma, convened in the city of Oklahoma City, Okla., on the date of May 24, 1933, and acting as a committee of the whole adopted the following resolutions:

"Whereas because of the ruthless and uneconomic overproduction of crude oil, the price structure has collapsed and thousands of wells of the stripper class, numbering more than 300,000, are on the threshold of being abandoned; and

"Whereas there is pending before the Congress of the United States a bill known as the Marland-Capper bill, the purpose of which is the conservation of crude petroleum and to preserve the same as a natural resource, not only for the future welfare of the Nation, but as a very vital item in national

"Whereas Federal intervention is welcomed as a means toward correcting the evils and corrupt practices which have driven the oil industry from a secure and profitable business into a state of chaos and bankruptcy; and

"Whereas the failure to delay the imposition of Federal control at this critical period will render definite and certain the loss of a valuable natural resource in the form of the stripper-well production, essential to the future welfare and property of many individuals, cities, and towns, and State governments who are directly and indirectly dependent on the prosperity of the petroleum industry; and now therefore be it

"*Resolved,* That the Stripper-Well Congress go on record in an affirmative manner, endorsing the Marland-Capper bill in its entirety; and be it further

"*Resolved,* That copies of this resolution be forwarded to the Secretary of the Interior, Secretary of War, to United States Senators and Representatives in the States wherein petroleum is produced, and to the Chairman of the House Ways and Means Committee, and to the press for publication, with the admonition to all that the vigorous administration of the bill, if enacted into law, will elevate the industry from bankruptcy to peace and prosperity, and contribute in a large degree to the general recovery of all business in the entire Nation."

Resolution offered by Smith, of Ardmore, Southern Oklahoma Oil & Gas Association.

Seconded by Mr. Weiner, Kansas Stripper-Well Association.

I. C. GRIMM, REPRESENTING THE GOVERNOR OF THE STATE OF OHIO

[Page 247]

As representative of Gov. George White and of the oil and gas associations of Ohio, I wish to sub-

mit for your serious consideration the following information concerning the deplorable condition of the oil industry in our State.

There are more than 36,000 producing oil wells in Ohio. This is one-ninth of all the oil wells in the United States. The average production of these wells is one-half barrel per well daily.

There are about 330,000 producing oil wells in the United States. Of this number, 250,000 produce one half barrel or less per well daily; 300,000 produce less than 1 barrel per day. Yet these "stripper wells" are the settled, dependable "backlog" of the oil industry. * * *

As a result of prevailing conditions of the oil industry in Ohio, thousands of high-paid workers are idle. The demand for equipment, such as belts, wire cables, gas engines, tubing, line pipe, casing, tanks, and derricks, are practically nil—this making other thousands idle. The State, county, and township lose large sums in taxes, which in turn closes schools and other activities. More than 2,000,000 acres of leases of oil and gas lands at $1 per acre have been surrendered, and this rental money paid the taxes of thousands of farmers, and these taxes are unpaid.

The principal cause of this crisis in the oil industry is overproduction in the flush pools in Western States. Bootleggers, proration violators, and the sellers of "hot oil" have caused demoralization in the industry, all of which is reflected by price cuts passed on to the producer, so that he cannot continue in business much longer. * * *

The average lifting cost per barrel for this settled production in Ohio is about $2 per barrel, and

the present sale price is from 50 to 90 cents per barrel.

Since 1929 the price of our oil called "Pennsylvania Grade" has dropped from $2.70 to 77 cents per barrel on May 9, 1932. Other grades are quoted at a considerable less price.

ARTHUR SEELIGSON, SAN ANTONIO, TEX.

[Page 250]

* * * * *

Oil today is being produced far under the cost of production. Sixty thousand small pumping or so-called "stripper" wells in Texas and Oklahoma, producing approximately 200,000 barrels of oil a day, are at stake. They, together with the settled production in other States, form the backbone of the oil industry. Do not lose sight of the fact that the flush pools of today become the settled pools of tomorrow and must be preserved. Unless there is some immediate improvement, these wells will have to be abandoned, and once abandoned are lost forever.

RALPH J. ZOOK, REPRESENTING THE GOVERNOR OF PENNSYLVANIA AND THE PENNSYLVANIA GRADE CRUDE OIL ASSOCIATION

[Page 272]

* * * * *

As representative of the Governor of the State of Pennsylvania, and as president of the Pennsylvania Grade Crude Oil Association, an organization composed of 400 producers, 30 of the 39 refineries running Pennsylvania grade oil, and 500 jobbers throughout the United States, I wish to

submit the following information for the consideration of the committee.

The Pennsylvania grade crude oil is produced in the western part of New York State, western Pennsylvania, western West Virginia, and eastern Ohio, throughout a territory consisting of approximately 170,000 acres, and from 146,000 of the total 300,000 settled producing wells of the United States.

The United States Tariff Commission, in a survey under report no. 30, second series, determined the cost of producing oil in the various oil-producing States of the United States and which developed the following average costs. With this cost, and in the second column is shown the present market price for Pennsylvania grade oil in the different States:

	Average cost, all companies	Present market price Pennsylvania grade
Ohio [1]	$2.00	$0.90
West Virginia	2.21	1.02
Pennsylvania	2.80	1.33
New York	3.00	1.37

[1] Includes all of Ohio, part of which is not Pennsylvania grade oil. The Ohio-Pennsylvania Grade Oil Producers Association estimate the cost of producing Pennsylvania grade at well above $3 per barrel.

A comparison of the average cost with the present market price shows clearly a deplorable condition in the Pennsylvania oil industry. The present market price is less than 50 percent of that needed to maintain the production of this area and shows the Pennsylvania producing industry losing at the rate of over $25,000,000 yearly.

Refineries running on Pennsylvania grade oil are not economically equipped to refine other grades of crude, and a continuation of the present

destructive prices will mean the eventual elimination of the Pennsylvania producer, and in time the refiner and marketer.

* * * * *

It is not for me to suggest the decision of the committee but to make the statement that under present conditions the Pennsylvania producing industry and later the refiners and marketers will become annihilated and take with it the banks, supply stores, merchants, and allied interests in the area covering western New York State, western Pennsylvania, West Virginia, and southeastern Ohio, and we ask that you consider that an emergency exists. It is a question of a short time before producers do not have sufficient income to repair leaby casing, wells are abandoned, and water comes in which forever eliminates the possibility of again producing oil from these wells. Under present prices the Pennsylvania producer's days are numbered.

Price relationship Oklahoma crude 36 grade and Bradford crude

	Bradford	Oklahoma	Difference	Percent of Oklahoma		Bradford	Oklahoma	Difference	Percent of Oklahoma
1911	$1.31	$0.46	$0.85	284	1922	$3.20	$1.70	$1.50	188
1912	1.60	.67	.93	238	1923	3.33	1.56	1.77	213
1913	2.46	.94	1.52	261	1924	3.70	1.63	2.07	227
1914	1.87	.76	1.11	246	1925	3.76	1.87	1.89	201
1915	1.70	.60	1.10	283	1926	3.77	2.13	1.64	177
1916	2.51	1.26	1.25	199	1927	3.16	1.38	1.78	229
1917	3.25	1.81	1.44	179	1928	3.36	1.31	2.05	246
1918	3.97	2.20	1.77	180	1929	3.95	1.37	2.58	288
1919	4.12	2.28	1.84	180	1930	2.60	1.23	1.37	211
1920	5.97	3.42	2.55	174	1931	2.02	.63	1.39	321
1921	3.33	1.65	1.68	202	1932	1.88	.88	1.00	214

2. Statements during Hearings on Conservation of Petroleum before the Committee on Ways and Means, House of Representatives, Seventy-third Congress, First Session (H. R. 5720, S. 1736):

T. S. HOGAN, REPRESENTING GOV. F. H. COONEY, OF MONTANA

[Page 78]

* * * In order to undertake to present the situation in the briefest and simplest form I submit the following summary of facts:

1. The producing oil wells in the United States have a combined capacity to produce many times as much oil per day as the market can consume.

2. Five great oil pools—East Texas, Yates, Kettleman Hills, Conroe, and Hobbs; 3 of which are in Texas, 1 in California, and 1 in New Mexico—if permitted to produce without restriction from their flowing wells, will destroy and render utterly valueless every stripper-well field and nearly all of the other fields of the country. Included in the areas unable to compete is all of the country east of the Mississippi with some 190,000 wells whose combined production averages about 108,000 barrels per day.

3. There is no power either in the States that would be adversely affected or in all of the oil operators of such States to protect themselves against this ruinous competition.

4. In spite of the great temporary capacity of flowing wells the total supply of oil reserves in every known field in the United States is only somewhere between twelve and fifteen billion barrels. With restored prosperity that supply would be exhausted in 12 years.

5. About 12 billion dollars are invested in the oil business directly and about 30 billion dollars in oil-powered vehicles and other machinery. No

rapid change can be made from oil products to other power for these machines.

6. Attempted control by interstate agreement is a demonstrated and continuing failure. The necessary authority for effective control is entirely lacking. * * *

The amount of oil in storage is roughly 590,000,000 barrels. That would supply the Nation for 9 months. The existence of so large a stock in storage is a constant menace to the stability of the price structure and it would be desirable if that supply could be reduced at the rate of 100,000 barrels per day, or 36,500,000 barrels per year. * * *

If it is true that east Texas has a potential, as has been stated here, of over 100 million barrels per day, that would seem to indicate that it could produce more than 40 times the Nation's requirements. If one group controlling a minority percentage of the field can, as has been claimed, produce 7 million barrels per day, then they alone can produce three times the amount of oil which the Nation can consume.

No stronger argument demonstrating the need of Federal supervision could be made. It is only fair to this committee, however, to say that the potential recently taken by the Railroad Commission of the east Texas field, and which showed a total potential of 123,360,000 barrels per day, does not show the true potential of that field. There is not a petroleum engineer or an experienced oil man in the world who would seriously claim that that wonderful field could produce anything like that amount even for one full day.

In making that test the highest number of wells opened to flow at any one time was 53 out of 10,000

wells in the field. The time of the test was only two hours. All the wells in the field had been closed for several days before the test was made. But after all allowances are made it is very evident that this one field can produce for sometime more oil than the whole Nation can use. If permitted to do that, it will break every independent operator in America, including these gentlemen who so vociferously protest against interference with their inalienable right of self-destruction.

In addition to the financial disaster which this policy would entail, the effect on the field itself would be almost equally disastrous. Time forbids an analysis of the physical waste involved in the unrestrained production of the field, but an illustration of what happened in the Winkler field in west Texas may be enlightening to the committee.

That field was brought into production in 1927 before there was any proration, either voluntary or mandatory, and at one time it reached a peak production of 367,000 barrels per day. Like in east Texas the wells came in with a high potential flow, the largest being about 60,000 barrels per day. The only restraint on production was the ability to find an outlet by train or pipe line or the building of storage.

Consequently, every producer tried to produce the greatest possible amount of oil in the shortest length of time. Within 2 years after that field had reached its maximum of 367,000 barrels per day it was producing only 40,000 barrels of oil and over 1,000,000 barrels of water which had to be disposed of at considerable expense.

That great field has produced to date over 160 million barrels of oil, but it is estimated that 75

million barrels of oil were permanently lost through the hasty and reckless manner of production which brought the water into the pay horizon and dissipated the oil.

RUSSELL B. BROWN, INDEPENDENT PETROLEUM ASSOCIATION OF AMERICA

[Page 97]

The present administration, recognizing the possibilities in the early recovery of the petroleum industry, and realizing the needless demoralization of that industry which now exists, invited a group of leaders in the petroleum industry to confer in Washington the latter part of March, with a view of proposing a program for Federal action. Wirt Franklin, president of the Independent Petroleum Association of America, under permission of the Secretary of the Interior, convened a general meeting of representatives of the petroleum industry to meet simultaneously with those previously invited by Secretary Ickes. To this general meeting convened by Mr. Franklin, invitations were sent to all the various groups, organizations, and associations in the industry. Special care was taken to invite every shade of thought, in order that the fullest discussion might be possible. A third group, composed of governors of oil-producing States, or of their representatives, was invited to Washington at the same time by Secretary Ickes.

The result of the deliberations of these three bodies, which joined together in a Committee of Fifteen, are well known. They proposed an immediate shut-down of flush pools; Presidential recommendation of conservation statutes in oil States

now without adequate laws; prohibition of interstate commerce in illegally produced petroleum; enforcement of gasoline and pipe-line taxes, and a recommendation that the President submit to Congress a request for emergency legislation, authorizing his appointment of a personal representative to cooperate with State authorities in carrying out a program to meet the existing emergency. The committee's report set forth, as possible assistance which might be given by the Federal Government, a comprehensive study of the petroleum situation, an adequate competitive tariff on foreign petroleum and its products, elimination of the Federal gasoline tax and pipe-line tax, delayed drilling on public lands, limitation of imports to the average of the last half of 1932, and continuation of the Federal Oil Conservation Board as an advisory body. The committee proposed that the oil-producing States might aid in recovery from the present emergency by enacting such adequate State laws as might be necessary, issuing and strictly enforcing valid orders, equitably allocating production between pools, limiting production, reaching an agreement to allocate the total market demand between the producing States, and encouraging permissive unit operation.

Among other suggestions it was proposed the petroleum industry might aid by refraining from producing oil unlawfully, by promoting permissive unit operation, by avoiding excessive storage withdrawals, by limiting drilling to the absolute minimum, and by limiting imports to the average of the last half of 1932.

These proposals were adopted by the three groups named. They represented compromises.

There were those who would have preferred to omit some portions of these recommendations. There were those who would have preferred to add other recommendations. It was agreed that this program was not ideal. It was also agreed, however, that the program was practical and would afford a prompt solution of the most serious phases of the existing emergency. There were those who did not agree. Some organized a separate conference in protest against some portions of these recommendations. They filed these protests with the President and with the Secretary of the Interior, and they are a matter of public record.

The President, at the conclusion of the conference, addressed a letter to the Governors of the various oil States, sending to each one a copy of the suggested program and stating that while he had no authority to declare a moratorium on oil production such as is proposed that "There seems to be a wide-spread feeling that an emergency exists in the oil industry calling for action, and it is hoped that the Governors of the States affected, after consultation with each other, will take action appropriate to meet it."

No action was taken by any of the States or by any of the Governors. Without concerted action by all the States, compliance with the Presidential suggestion by one State alone would not have solved the problem and there was no authority authorized to call together the Governors for immediate action. Furthermore, legislative action would have been required in many States. This action was not immediately possible.

The program as outlined, in many of its features, was made the basis of tentative drafts of possible

legislation for presentation to Congress. Conferences were held between representatives of all sections of the petroleum industry and the Secretary of the Interior. Out of these proposals there came suggestions for many changes in the legislation proposed. Inevitably some groups, in spite of their adherence to the original program, suggested alterations which might be to their supposed advantage. The general unanimity, made the more marked by the organization of the minority opposition into a separate association, was soon broken. It became increasingly evident that the industry could not agree, and that such temporary agreements as might be reached would afford no sound basis for permanent solution of these problems.

Meanwhile the situation of the petroleum industry became still more desperate. Failures, bankruptcies, closing of wells, increasing unemployment of workers accompanied the practically unlimited production of petroleum in the State of Texas.

It seemed that this important industry was doomed to suicide. The peculiar nature of petroleum complicated this. Unrestrained production of one section stimulated overproduction in neighboring sections. The contagion spread until the whole structure of the industry seemed about to crash.

J. D. SANDEFER, JR., PRESIDENT OF THE WEST CENTRAL TEXAS OIL & GAS ASSOCIATION

[Page 103]

I appear before you as an independent oil operator of Texas and as president of the West Central Texas Oil & Gas Association, with a membership of 300. We do not have a representative of any major

company or purchaser of oil in our association. This association covers 16 counties in west Texas with 8,127 wells averaging approximately three and one-half barrels per day.

I also represent the North Texas Oil & Gas Association, this being a similar association in north Texas, covering approximately eight counties and having 15,000 stripper wells, producing 50,000 barrels daily.

A great number of the wells in the above districts have been shut down at this time, due to the chaotic conditions which exist. We are unable to produce these small wells on the present price of oil, which is 25 cents per barrel. * * * As stated heretofore, most of the wells in our district produce salt water, and it is necessary to keep them in continuous operation or else oil-bearing strata will be overcome by the water and the wells definitely ruined. Therefore if this great natural resource is to be conserved in our section of Texas, it is necessary that we immediately have some relief, as we are unable to operate these wells at this time. This, of course, adds to our already heavy unemployment situation which is very acute.

W. SCOTT HAYWOOD, STATE SENATOR AND HONORARY CHAIRMAN AND VICE CHAIRMAN OF THE LOUISIANA TAX REFORM COMMISSION AND MEMBER OF THE OIL STATES ADVISORY COMMITTEE

[Page 108]

Recent developments in the petroleum industry compel me to suggest the importance of immediate Federal control to regulate production, refining, and transportation of petroleum and its products,

and also to impose definite restrictions upon imports. Political manipulation without experience in the oil industry is, in Texas, playing into the hands of the purchasing companies; and if this is not checked by Federal control, it will exterminate the independent producers, refineries, and distributors, and will effect the monopolistic control of the entire industry by a few large companies.

I also wish to call to your attention the fact that since the East Texas field was brought in that millions of barrels of Texas cheap oil has been coming in competition with Louisiana oil and has brought about the abandonment of approximately 3,000 settled producing pumping wells.

SHERMAN HUNT, TYLER, TEX.

[Page 111]

Our wells in Louisiana and in Arkansas are now closed down. We are unable to continue their production because of the situation created by the unlimited production of oil in east Texas. We have been forced to discharge our employees in these two States, in spite of our dislike of adding still more to the large number of the unemployed. Our wells are not the only ones closed in these States. There are countless others who duplicate our experiences. We do not know whether our wells will ever have any value if we reopen them. We are afraid that salt water will have destroyed their future production. Even if that destruction is not total, the productive possibility of the wells will be greatly diminished and the cost of production will be equally increased because of their shut-down.

This, too, is the experience of countless other owners of wells of settled production.

V. S. WELCH, ARTESIA, N. MEX.

[Page 117]

New Mexico, having many oil fields of settled production which must be shut down and their future production utterly lost unless some Federal movement is inaugurated to prevent one or two States with new flush areas from completely ruining the American petroleum industry, will find in the Federal oil-control bill proposed as an amendment to the General Industries Act a positive lifesaver.

The welfare of the petroleum industry is essential to the prosperity of New Mexico. The control of our own industry, however, has passed out of the authority of this State and is now, at least temporarily, lodged in the Texas Railroad Commission, which is able to decree our complete ruin without any compensatory advantage being gained by Texas itself. The rights of New Mexico are utterly ignored, as are the rights of all other States with settled production. We have no recourse except through Congress. If the Congress of the United States should pass the Marland bill, giving to some Federal officer authority to equitably allot to the various oil-producing States their proper share in the market demand, this would be of incalculable value to thousands of people in New Mexico and would conserve for future generations those great deposits of petroleum which are being reached by our pumping wells, but which will be forever lost if these wells are shut down. It is im-

possible to continue production from these wells, however, if the flush fields of east Texas or of any other State are permitted to flood the market with oil at ruinous prices.

WILLIAM BELL, PRESIDENT OF THE ILLINOIS-INDIANA PETROLEUM ASSOCIATION

[Page 118]

The Illinois-Indiana Petroleum Association, of which I am president, urges the adoption of the Marland Federal oil-control bill as an amendment to the General Industries Recovery Act.

Over 15,000 stripper wells in southeast Illinois and southwest Indiana, located near the center of the population of the United States, are facing ruin unless Federal control of petroleum production can be established. We do not believe that any form of State control or production limitation by individual agreement can help us or similar wells scattered over the oil-producing States.

We have large reserves of valuable petroleum still in our sands. These reserves constitute a very large portion of the total known oil reserves of the Nation. If these wells close, this oil will be forever lost since it cannot be recovered by any method in use today.

These valuable fields are facing early extinction because petroleum prices today are far below the cost of production. Their closing will entail severe losses falling upon producers, royalty owners, labor, and the general public. The loss of an immense amount of petroleum which will be produced hereafter from these wells will ultimately mean an increased price paid by the consuming public for petroleum products.

MARVIN LEE, WICHITA, KANS.

[Page 119]

Kansas has endeavored to make effective corrective measures intended to prevent destruction of the State's natural resource values, and to promote development of one of her greatest assets. In May 1931 the ratable taking law of Kansas became operative under the Public Service Commission. This commission, with the cooperation of producers, adjusted flush production outlets in this State. While these efforts were of temporary value, their effect has been destroyed by the uncontrolled production elsewhere, which has demoralized the entire industry, taken the natural markets for Kansas oil, and involved either the actual or the threatened closing of many wells of settled production which should, under any rational program for the whole industry, provide the Nation with great quantities of petroleum for many years to come. Unless some measure is taken by Congress to meet this situation, all the efforts of the State of Kansas, its Legislature, its authorities, and of the oil industry within the State will have been made null and void.

Kansas has been doing the utmost within its power to provide an orderly development of the new areas in western Kansas. In no other State has a larger area of proven production been found without causing a rush of drilling. In no other State are so many fields shut in without market. Both the State and the industry have done everything in their power to prevent waste of this irreplaceable resource which is now being threatened because of the unwillingness of other States to ex-

ercise the same care in the adoption or in the enforcement of proper laws for conservation.

VII. COMMUNICATIONS URGING CONTROL OF PRODUCTION BY THE FEDERAL GOVERNMENT

1. Proposal from the Oil States Advisory Committee to the Federal Oil Conservation Board:

WASHINGTON, D. C., *April 9, 1931.*

To the Honorable RAY LYMAN WILBUR,
Chairman of the Federal Oil
Conservation Board, City.

HONORED SIR: We, the undersigned members of the Oil States Advisory Committee, duly appointed by the governors of the respective States, which we represent to consider the present dire conditions of chaos and distress existing in the oil industry and to make recommendations for the betterment of such conditions, having requested of the Honorable Federal Oil Conservation Commission a conference as of this date, hereby submit the following:

First. Stabilization of the production of crude oil is necessary to stability of public supply; to the elimination of a waste of an irreplaceable resource; to prevention of the threatened forced abandonment of hundreds of thousands of small wells throughout the oil-producing areas of the United States; to preservation of the independent oil-producing areas of the United States; to preservation of the independent oil operator as a competitive force, thereby avoiding the creation of monopoly; and to the prevention of loss of many millions of dollars in tax revenues to the various states and to the nation.

Second. No individual oil-producing state, by its own laws, can adequately protect the national interests against such conditions of overproduction, attendant waste, and resultant demoralization of a great industry as now exists unless the conservation efforts of the large producing states shall be coordinated. Otherwise curtailment efforts within one state may be at any time automatically offset and nullified by increased flush production in the fields of another state, or by unjustified increases in importations, to the great damage of the areas of old and settled production throughout the country.

Third. Through bitter experience the various oil-producing states have been forced to the realization that the conservation authorities of each state must give due consideration to the general situation in the oil industry throughout the United States. With such consideration duly given, the stabilization of the production of crude oil within any state is purely a problem for solution by that state and the industry therein, with such cooperation and advice as may be rendered by interstate advisory committees and with such aid and assistance as the federal government may be able to give. Limitations on unnecessary drilling, conservation of gas energy, encouragement of unitization of development, ratable takings of oil among producers within a given field, and equitable apportionment of outlet as between the various fields should be the objectives of the various state laws, and for the better saving in the ground of oil and gas not immediately needed the state laws should be made more uniform and more effective in their enforcement.

Fourth. Coordinated restrictions to prevent wasteful overproduction by the major oil-producing states, with federal cooperation, may be furthered immediately by continuing for such time as may be necessary an advisory group representing the various states and by the conservation bodies within those states adopting, as a basis of regulation of production, the regional forecasts of supply and demand such as have just been made by the voluntary committee on economics of the Federal Oil Conservation Board, if and when same shall have been approved or modified by an interstate advisory committee.

Fifth. Equalization of the rate of foreign production, with due consideration for the proration efforts of the domestic producers, should be sought, not only to curtail imports but to safeguard the country's balance in exports, and we hereby fully endorse, and tender our thanks to your honorable Board for, the efforts put forth in procuring voluntary restrictions of imports into this country.

Sixth. The above objectives, i. e., sound and uniform conservation laws within the various states, coordination of their enforcement and effect with those of other states, balancing of their joint effect against foreign production, all under a system which will be stable for sufficiently long periods to enable economic production expenditures but flexible enough to meet changing conditions, may and should be placed on a permanent basis by means of an agreement between the oil-producing states, which will retain for each state its own administration of its own resources but will guarantee harmonious administration and cooperation through an interstate advisory board.

In view of the foregoing conditions, we hereby recommend:

1. That the Federal Oil Conservation Board continue its voluntary committee on economics to make periodic examinations into the status of the oil industry and formulate national and regional forecasts of supply and demand, and that such forecasts be given due consideration by the interstate committee and recommended, with any necessary modifications, to the respective state conservation bodies.

II. That the legislature of each oil-producing state be requested as rapidly as possible to authorize negotiation of an interstate agreement for coordination of conservation measures, any such agreement being subject to ratification by the states.

III. That pending the working out of such a compact an advisory committee, representing the several oil-producing states, continue to function as a liaison and fact-finding body, to present to the conservation authorities of the various states, at such times as may be deemed necessary, recommendations for more effective cooperation as between states.

Respectfully submitted.

Cicero I. Murray, Chairman, Oklahoma; Wm. H. Cooley, California; Robert R. Penn, Texas; W. Scott Heywood, Louisiana; Van S. Welch, New Mexico; Alfred M. Landon, Kansas; Carl M. Cox, Wyoming; I. C. Grimm, Ohio; Warwick M. Downing, Colorado.

2. Telegrams and letters from Governors of oil-producing States urging Federal control (printed in report of Hearings on the National Industrial Recovery Act before the Senate Committee on Finance, 73rd Cong., First Sess. (S. 1712, H. R. 5755)):

[Page 43]

On May 12, Governor Landon, of Kansas, wired as follows to the President:

"In re oil industry it appears that at least one major company (and it is expected that some others will do likewise) with large amount of empty storage is planning to largely increase its purchases. This will increase outlet and production allowable of that company's own production and also allowable of any other integrated company on the production in any pool or pools that might be affected. It will also force all independent producers to sell their increased allowable in order to protect their leases from drainage, thus giving such larger companies with their own pipe lines and empty storage a supply of oil at prices much lower than cost of production. This oil will then go into storage and later when conditions are stabilized it will be withdrawn from storage and purchases of currently produced crude will be correspondingly reduced. In other words, their future requirements will be anticipated on the present ruinous price basis. Time therefore becomes the essence, because if this condition is permitted to continue each day that passes will see just that much more of the below-cost oil go into this empty storage. The small independent producer is helpless. He needs money even if it means a conversion of his

capital at a loss and he has no storage of his own and in any event must protect his leases from drainage by producing his allowable amount. Therefore express the hope that, not only for the general pressing reasons which are familiar to you but for this added special one which has just developed, proper legislation be expedited, and I proffer any aid or assistance I may be able to render.

"ALF. M. LANDON,"

[Page 46]

COMMONWEALTH OF PENNSYLVANIA,
GOVERNOR'S OFFICE,
Harrisburg, April 7, 1933.

The PRESIDENT,
The White House, Washington, D. C.

DEAR MR. PRESIDENT: Many thanks for your letter of April 1. I have given it careful consideration and now desire to express my strong approval of those parts of the report of the committee of fifteen which you approve, including in particular paragraphs A–3 and A–4 of the communication of March 29 addressed to the Secretary of the Interior by a committee representing the governors of the oil-producing States, the independent oil and gas associations, and the major oil- and gas-producing and importing companies.

In addition, I desire to raise the question whether [illegible] as he deems necessary in the limitation of daily production to present requirements; in the limitation of the amount drawn from storage,

based on last year's withdrawals; and in the limitation of imports (possibly the fixing of prices for the different grades of oil), and in forming a board with governmental authority to carry out this plan.

I am informed that there are important bodies of opinion among oil men in Pennsylvania in support of the foregoing suggestions.

As with oil, so with coal. I am vigorously of opinion that strong executive measures are absolutely necessary before either industry can hope for a return to prosperous times.

Sincerely yours,

GIFFORD PINCHOT.

[Page 48]

AUSTIN, TEX., *May 25, 1933.*

Hon. HAROLD L. ICKES,

Secretary of the Interior:

Replying to your letter of May 22, beg to advise that bill H. R. 5695 by Marland meets with my approval, and I think its early passage is demanded to stop the illegal overproduction of oil in Texas and perhaps elsewhere. We have a deplorable condition in Texas, and from reliable information it appears that the production of oil in violation of our proration laws exceeds the amount permitted by our proration laws. In my opinion, prompt action by the Federal Government is the only effective remedy of this condition which is resulting in [illegible] natural resource and at the same time an inexcusable loss in taxes to the State and the royalty owners. Assuring you of my willingness to cooperate with you to

the fullest extent to bring about needed relief, I am respectfully yours,

MIRIAM A. FERGUSON,
Governor of Texas.

FRANKFORT, KY., *May 13, 1933.*

Hon. FRANKLIN D. ROOSEVELT,
Washington, D. C.

Because of excessive and uncontrolled production of crude oil from flush wells in Texas resulting in unprecedented low prices of crude oil with which the thousands of small wells in Kentucky cannot compete, our local oil industry is demoralized and threatened with complete prostration. I earnestly request that you give the support of your administration to the measure recently prepared by a committee representing the Governors of Kansas, Oklahoma, and Pennsylvania, whereby the Secretary of the Interior is given dictatorial powers over the oil industry. The oil men of Kentucky believe that this particular measure is preferable to any other that has been proposed and understand it has the full support of the Secretary of the Interior.

RUBY LAFFOON,
Governor of Kentucky.

GOVERNOR'S CHAMBERS,
Sacramento, Calif., April 11, 1933.

The PRESIDENT OF THE UNITED STATES,
Washington, D. C.

DEAR MR. PRESIDENT: I have the great honor to acknowledge receipt and to thank you for your letter of April 1 and the oil committee recommenda-

tions which accompanied it. They were promptly sent to both houses of our legislature now in session, and a copy of my letter of transmittal is attached hereto.

My delayed acknowledgment is due to the fact that before writing you I desired to confer with the various factions of the oil industry in California, in the hope that inspired by national recommendation of the need for action, and by your desire to stabilize the industry, the differences which have heretofore existed in California might happily be compromised. I deeply regret that I cannot assure you of my success.

The dissenters are made up of a small group representing not more than 5 percent of the production in the State. They have persistently refused to subscribe to the plan of voluntary curtailment in this State, which with their cooperation would now be adequate to meet the situation here without statutory enactment. The minority report recently filed in Washington is their statement.

Two years ago our legislature passed, and I signed, a bill introduced by Senator William Sharkey, designed to control the production of crude oil. This control was lodged in a board to be elected by the oil producers. A small group of producers were dissatisfied with the bill and opposed its passage, stating that they would resist any regulatory legislation. The referendum was invoked, and a public campaign followed in which the charge was made that the ratification of this measure by the people would result in monopolistic control of the oil industry by the major companies, and

in 30-cent gasoline, which would be a higher price than that paid during the war period.

I have never thought the opponents of the Sharkey bill really believed either of these statements to be correct, but those unable to acquaint themselves with the facts undoubtedly accepted the statements as true, and the bill was defeated 4 to 1.

Please be assured of my sincere desire to collaborate with you in a national plan of oil proration, and it is my earnest hope that the California Legislature will seriously consider the recommendations of the national committee now before it. With personal regards to you,

Respectfully and sincerely yours,

JAMES ROLPH, JR.,
Governor of California.

[Page 50]

OKLAHOMA CITY, OKLA., *May 3, 1933.*

The PRESIDENT,
The White House.

The undersigned Governors of the States of Oklahoma and Kansas make reference to your letter of March 28 addressed to us. We have just met in conference, the subject matter of that conference being your letter and the present demoralized condition of the petroleum industry. We have reached the following conclusions and make the following suggestions:

First. We are of the opinion that aid must be forthcoming from the Federal Government, this to take the form of an appropriate act of Congress which has as its basic object the balancing of the supply and demand and the fair apportionment of

such demand as may exist for crude oil among not only the various producing States but also among the various pools therein. We have before us copies of a proposed law which has been presented to the Secretary of the Interior and which press dispatches state he has transmitted to you for examination without discussing either legal or a number of detail features of that proposed law. We state that we generally are in accord with its apparent objectives. We emphasize the fact that our States have particularly suffered because of the lack of control over allocations of purchases which in turn, among other reasons, result from a failure to properly limit imports.

We believe that fair and proper legislation should further provide in substance for a limitation of imports to an amount not exceeding the average daily imports for the last 6 months of the calendar year 1932, which was the unanimous recommendations of the committee of 15, composed of representatives of governors, major companies, and independents at the Washington conference on March 27 last. The Governor of Kansas has appointed as his representatives:

E. B. Shawver, president Producers and Land Owners' Association of Kansas.

Carl Weiner, president Stripper Oil Well Association.

Ralph J. Pryor, chairman State Oil Advisory Committee.

The Governor of Oklahoma has appointed as his representatives: Cicero I. Murray, Wirt Franklin, W. N. Davis.

We have given authority and instructions for those appointed to go to Washington as our rep-

resentatives to solicit from the National Administration and Congress such aid and cooperation so necessary to accomplish these specific purposes mentioned above and generally do what they can with aid of your Excellency and Congress to restore prosperity to this great basic industry.

WM. H. MURRAY,
Governor of Oklahoma.
ALFRED M. LANDON,
Governor of Kansas.

EXECUTIVE DEPARTMENT,
Austin, Tex., May 5, 1933.

Hon. FRANKLIN D. ROOSEVELT,
President, Washington, D. C.

MY DEAR MR. ROOSEVELT: I today wired you as follows:

"The oil industry in Texas is still in a very confused and desperate condition. The illegal production of oil perhaps approximates the legal production of oil. Known violators of our proration laws appear to have the confidence of our railroad commission, which under its powers is permitting an overproduction of oil amounting to 400,000 barrels daily. Lack of power of the State to control interstate shipments and the importation of foreign oil, coupled with the failure of our railroad commission to control the situation, makes it doubtful whether the oil situation in Texas and Oklahoma and other oil-producing States can be successfully controlled by State jurisdiction.

"Our situation in Texas grows worse every day, and the people, especially in east Texas, are becoming desperate; and while there has not yet been

any serious outbreak, there is so much intemperate expression and ill-feeling in the minds of the people that we will not be surprised if a serious situation might develop any day. In view of this perilous condition, and the ruinous and ridiculous prices now being paid the producers, which are destroying the industry, I have decided to say to you that, in my opinion, the public service will be best conserved by the prompt passage of laws that will give to you authority to take charge of the oil industry as emergency legislation, to continue for at least 2 years, or until the present deplorable situation is relieved. I do not have in mind any particular verbiage, but I suggest the passage of legislation in the form and substance of the Capper bill or Ickes bill as mentioned in the dispatches. I had hoped that conditions might have improved to where the action here suggested might be unnecessary, but the failure of the legislature to give the executive department any power to act in the premises and the apparent indisposition of our railroad commission to act with any dispatch make it my duty to call the matter to your attention in the hope that your good offices might be enlisted in the rendering of an imperative service. You are at liberty to give this communication to the press, and a letter of even date will follow giving further facts", which I beg now to confirm. It appears that our petroleum industry in Texas as well as in other States is in a very chaotic condition. I had hoped that the situation might be composed and that respect for our proration laws would long before now have had the effect to bring about an orderly production of oil. It appears, though, that such is not

to be the case under present conditions and arrangements.

The problem confronting us in Texas is that there is a silent war going on between those who want to produce oil illegally and those who want to comply with the law. Unfortunately, the violators of our proration laws have had too much encouragement from those in authority. The violators have construed their recognition as a license, as it were, to produce and they have produced many million barrels of oil in violation of law and without paying royalty to the owners of the lease or taxes to the Government. Recently the railroad commission issued an order which permitted the production of nearly double the amount of oil required, and this soon resulted into an abnormal surplus which has almost destroyed the value of oil, and it is now selling legally and illegally in enormous quantity at 10 cents a barrel.

For some reason, best known to themselves, our railroad commission seem determined to authorize this ruinous production, and if such a policy is continued it will perpetuate further destruction of a valuable natural resource, and it will so intensify the feelings of the people as to incite them to exasperation which soon will result in a disregard for all law and violent conflicts will undoubtedly result.

It is my opinion that if something is not done quickly the entire industry in the United States will be destroyed and profitable operations of oil wells will be impossible. As we have such an enormous area in Texas that is known to be underlaid with petroleum, it can be readily seen how our excessive production will affect the price of the product. It is pressingly necessary for prompt enforce-

ment of the proration laws in all parts of our State in order that we may escape the disastrous consequences of overproduction in the way of low prices.

As stated in my message, any State labors under considerable difficulty in dealing with oil shipped interstate and oil imported into the different States. These matters are peculiarly under the jurisdiction of the Federal Government, and the volume of business involved greatly overtaxes and expands the facilities of the State to cope with the situation. In addition, the magnitude of the undertaking is so great that the expense is quite burdensome to the State and it is difficult to provide the funds necessary to accomplish the necessary control of the industry.

It has been suggested that these matters might be fit subjects for compact agreement between the States. There is merit in the suggestion, but I think the hopes of relief from compact agreements between the States would be remote, and certainly they would come after years of litigation in the courts. The situation is now so pressing that some agency must be set up with iron-hand authority to get results. It is in view of these facts that I have come to the conclusion, reluctantly, that the only solution is for the matter to be placed under your jurisdiction and authority until the emergency is passed. I indeed regret that request for such action on the part of our State is necessary, but it appears that there is no other course.

With best wishes for your health and success and with continued esteem, I am

Faithfully yours,

_____ _____,

Governor of Texas.

VIII. RAILROAD COMMISSION OF TEXAS, PRODUCTION AND STORAGE REPORT FOR THE EAST TEXAS FIELD, SEPTEMBER, 1934

This report takes into consideration all information regarding the following items:

(1) All outlets to the east Texas field:
   a. Pipe-line deliveries out of the field.
   b. Refineries runs to stills.
   c. Tank-car shipments out of field.
(2) Storage increase or decrease:
   a. Pipe-line Storage.
   b. Gathering System Storage.
   c. Lease Storage.
   d. Refinery Storage.
   e. Treating Plant Storage.
(3) Authorized oil in excess of the allowable:
   a. Pit oil and and tank bottoms.
   b. Shallow or salvage oil.
   c. Scrubber from Gasoline Plants.
(4) Amount of production allowed each day.
(5) Refinery situation.
(6) Refined products shipments by tank cars.
(7) Activities of violation department.
(8) Recapitulation.

1. *Outlets to the East Texas field.*—Crude oil from the East Texas field has three outlets.

(A) By twelve major pipe-line companies with one 6″ line, twelve 8″ lines, seven 10″ lines, and three 12″ lines, capable of moving approximately 1,000,000 barrels crude oil daily.

(B) By 79 Refineries, capable of running approximately 197,950 barrels crude oil daily to their stills.

(C) By four Railroads with 50 loading racks, capable of loading approximately 500 cars of crude oil or refined products daily.

(A) PIPE-LINE DELIVERIES

LEAVING THE EAST TEXAS FIELDS

(*Main Lines*)

Total Barrels	12,710,753
Daily Average	423,692

(B) REFINERIES RUNS TO STILLS[1]

TO LOCAL REFINERIES

Total Barrels	2,157,261
Daily Average	71,909

(C) TANK-CAR SHIPMENTS, CRUDE OILS

OUT OF EAST TEXAS FIELD

Number of Cars	170
Total Barrels	38,080
Daily Average (Barrels)	1,266

2. We are taking into consideration on this report five classes of storage: (a) Pipe-line Storage, (b) Gathering-System Storage, (c) Lease Storage, (d) Refinery Storage, (e) Treating-Plant Storage.

(*a*) PIPE-LINE STORAGE (BARRELS)

7 a. m. September 1, 1934	3,895,461
7 a. m. October 1, 1934	3,592,219
Storage Decrease	303,242
Daily Average	10,108

(*b*) GATHERING-SYSTEM STORAGE (BARRELS)

7 a. m. September 1, 1934	1,574,400
7 a. m. October 1, 1934	1,195,859
Storage Decrease	378,541
Daily Average	12,618

[1] All refineries in the field are not reporting to the Commission but the "Runs to Stills" are arrived at by using the figures on the ones that are reporting and on the ones that are not reporting our scouts call on them each day and ascertain the amount run to stills.

(c) LEASE STORAGE (BARRELS) [2]

7 a. m. September 1, 1934	1,271,866
7 a. m. October 1, 1934	1,394,856
Storage Increase	122,990
Daily Average	7,433

(d) REFINERY STORAGE (BARRELS)

7 a. m. September 1, 1934	773,140
7 a. m. October 1, 1934	895,644
Storage Increase	122,504
Daily Average	4,083

(e) TREATING-PLANT STORAGE (BARRELS)

7 a. m. September 1, 1934	33,899
7 a. m. October 1, 1934	30,157
Storage Decrease	3,742
Daily Average	125

3. *Authorized oil in excess of the allowable*—(a) *Pit oil and tank bottoms.*—Permits were approved for tank bottom and pit oil during the month, for 14,162 barrels of oil to be run by reclamation plants. Waste Oil picked up from creeks, loading racks, and refinery waste amounted to 28,085 barrels. Of this amount approximately 56% was charged back to the lease allowables, leaving 23,698 barrels run which is in excess of the allowable.

(b) *Shallow wells or salvage oil.*—A total of 2,711 barrels of oil was run from the Mollie Fenn lease during the month.

(c) *Scrubber oil from gasoline plants.*—A total of 1,000 barrels of oil was run to pipe lines from various gasoline plants.

	Barrels
Pit oil and tank bottoms	23,698
Shallow wells or salvage oil	2,711
Scrubber oil	1,000
Grand total	27,409
Daily average	914

[2] 155 Producers did not report and their storage is not included in this report.

4. On September 1, 1934, there were 14,392 wells producing in the East Texas field. During September there were 265 wells completed, making a total as of October 1, 1934, of 14,657 wells.

Actual allowable, September 1, 1934 to September 30, Inclusive

Date	Marginals	Wells	Potentials	Prorated hourly potential	Daily allowable
				Percent	
Sept. 1	1,407	14,396	10,526,681	4	425,006
Sept. 2	1,407	14,402	10,531,056	4	425,181
Sept. 3	1,409	14,407	10,534,021	4	425,306
Sept. 4	1,411	14,414	10,538,731	4	425,500
Sept. 5	1,412	14,420	10,543,196	4	525,581
Sept. 6	1,416	14,434	10,552,501	4	426,064
Sept. 7	1,416	14,446	10,561,226	4	426,413
Sept. 8	1,416	14,450	10,564,151	4	426,530
Sept. 9	1,417	14,456	10,568,211	4	426,696
Sept. 10	1,422	14,470	10,576,656	4	427,047
Sept. 11	1,426	14,484	10,585,211	4	427,401
Sept. 12	1,429	14,495	10,592,236	4	427,691
Sept. 13	1,431	14,505	10,598,941	4	427,964
Sept. 14	1,434	14,516	10,605,776	4	428,246
Sept. 15	1,435	14,524	10,611,711	4	428,486
Sept. 16	1,437	14,527	10,613,286	4	428,555
Sept. 17	1,437	14,539	10,622,626	4	428,928
Sept. 18	1,437	14,545	10,626,666	4	429,090
Sept. 19	1,440	14,559	10,636,701	4	429,500
Sept. 20	1,442	14,565	10,640,661	4	429,664
Sept. 21	1,443	14,574	10,647,751	4	429,950
Sept. 22	1,443	14,578	10,650,881	4	430,071
Sept. 23	1,445	14,583	10,653,666	4	430,192
Sept. 24	1,447	14,601	10,666,141	4	430,697
Sept. 25	1,449	14,612	10,673,971	4	431,050
Sept. 26	1,450	14,621	10,680,001	4	431,260
Sept. 27	1,452	14,632	10,687,936	4	431,583
Sept. 28	1,453	14,640	10,693,221	4	431,797
Sept. 29	1,453	14,648	10,699,281	4	432,039
Sept. 30	1,453	14,657	10,705,911	4	432,264
Total Allowable (Barrels)					12,855,852
Daily Average Barrels)					428,528

5. *Refinery situation.*—During the month of September there was a total of 80 refineries in the East Texas Field. During the month 64 of these plants operated, 16 of the total were shut down the entire month and 2 of them were under construction. Out of the total that operated, only 58 plants operated more than fifteen days during the month.

6. Refined products shipments by tank car.

Commodity	Number of cars, August	Number of cars, September
Gasoline	4,844	4,403
Fuel Oil	3,212	2,782
Topped Crude	910	1,315
Gas Oil	965	714
Kerosene	416	379
Distillate	727	1,053
Naphtha	2	1
Residium	610	569
Casinghead Gasoline	522	526
Crude Tops	82	32
Total Number of Cars	12,284	11,774
Daily Average	395	392

7. Activity of the violations department during the month of September 1934—Refineries.—Thirty-six violation reports were forwarded to the Attorney General's Department for further legal action, charging 17 refineries with receiving untendered oil in contravention of the rules and regulations of the Railroad Commission and representing a total of 106 penalty days.

Thirty-five reports were forwarded to the Attorney General's Department charging 35 refineries with failure to submit E–H–2 reports, as required by the Rules and Regulations of the Railroad Commission, involving 1,050 penalty days.

(A summary of the above will show that during the month of September 1934 seventy-one (71) violation reports were forwarded to the Attorney General's Department for proper legal action, charging thirty-six (36) refining companies with infringement of the Rules and Regulations of the Railroad Commission and representing a total of 1,156 penalty days.)

Judge W. F. Robertson of the 126th District Court of Travis County, Texas, granted temporary restraining order against 29 refineries located in the East Texas field for having open earthen stor-

age for oil at their refinery site in contravention of Rule No. 39 of the Railroad Commission of Texas entered in Oil and Gas Docket on April 3, 1934, stating that open-earthen storage for oil is hereafter prohibited except when the Commission grants special permission in order to meet an unforeseen emergency.

Operators.—Sixteen criminal violations were reported to the district attorneys of the counties wherein the violations took place charging various operators with overproduction, using a means and device to evade and prevent accurate measurement of oil (bypass), conveying oil into possession of another otherwise than from tanks, not burning a flare simultaneously with production, etc.

8. *Recapitulation*

	Barrels
Crude oil leaving field:	
Pipe Line Runs	12,710,753
Refinery Runs to Stills	2,157,261
Tank Car Shipments	38,080
Total	14,906,094
August storage:	
Pipe Line (Decrease)	303,242
Gathering System (Decrease)	378,541
Lease (Increase)	122,990
Refinery (Increase)	146,311
Treating Plant (Decrease)	3,742
Total Net Decrease	416,224
Authorized oil run in excess of allowable:	
Pit Oil and Tank Bottoms	23,698
Salvage Oil or Shallow Wells	1,000
Scrubber Oil	2,711
Total	27,409
Total oil run	14,462,461
Total September allowable	12,855,852
September production over allowable	1,606,609
Average daily production over allowable	53,554
Per well average daily production over allowable	3.65

RAILROAD COMMISSION OF TEXAS,
Oil & Gas Division, Kilgore, Texas.
By D. W. POWER, *Auditor.*

IX. CODE PROVISIONS AUTHORIZING LIMITATION OF PRODUCTION

The following codes, listed in the order of their approval, either directly provide for limitation of production upon a quota basis or authorize such limitation upon specified conditions or contingencies:

Lumber and Timber Products (Art. VIII).
Petroleum (Art. 111, Secs. 3–5).
Glass Container (Art. VI, Sched. A).
Cement (Art. VI).
Corrugated & Solid Fibre Shipping Container (Art. VII).
Atlantic Mackerel Fishing (Art. VIII, Title C, Sec. 1 (c)–(e)).
Copper (New Art. VII, 6 (12)(a). (See order approving code.)

The following codes, listed in the order of their approval, authorize limitation upon the hours of operation of machines or plants:

Cotton Textile (Art. III, 2).
Wool Textile (Art. IV).
Coat and Suit (Part I, Third).
Lace Manufacturing (Art. III).
Corset and Brassiere (Art. 4).
Men's Clothing (Art. IV).
Hosiery (Art. IV, 6–8).
Cast Iron Soil Pipe (Art. 6).
Wall Paper (Art. IV (b)).
Underwear and Allied Products (Part I, Art. IV; Part III).
Textile Bag (Art. III (b)).
Glass Container (Art. VII; Sched. "C")
Silk Textile (Art. III, 1).
Umbrella (Art. III, 2).
Handkerchief (Art. III, 2).
Throwing (Sec. II (d) 1).
Dress Manufacturing (Art. III, 4).

Canning and Packing Machinery (Art. III (e)).
Nottingham Lace Curtain (Art. III).
Novelty Draperies (Art. III, 4).
Funeral Supply (Art. III, 2).
Cotton Garment (Art. V).
Newsprint (Art. III, 1).
Upholstery and Drapery (Art. III, Sec. 4).
Cigar Container (Art. III, (d)).
Machined Waste (Art. III, 2).
Rubber Manufacturing (Chap. X, Art. IV-A, Sec. 1).
Hair Cloth (Art. III, 5).
Knitted Outerwear (Art. III, (d)).
Wax Paper (Art. III, 4).
Rayon and Silk Dyeing (Art. III, 5, 6).
Medium and Low Priced Jewelry (Sched. G, 2 (a)).
Velvet (Art. VIII).
Paper Stationery and Tablet (Art. III, 4).
Blouse and Skirt Manufacturing (Art. II, 5).
Robe and Allied Products (Art. III, 5).
Slit Fabrics (Art. III, 8).
Drapery and Upholstery Trimming (Art. III, 4).
Dental Laboratory (Art. III, Sec. 7).
Envelope Manufacturing (Art. VI).
Light Sewing (Art. III, 4; Div. 2, Art. III).
Wet Mop (Art. III, 3).
Textile Processing (Art. II, 4).
Advertising Display Installation (Art. III, 1).
Schiffli, Hand Machinery, etc. (Art. IV, 1 (b)).
Hat Manufacturing (Art. II, 5).
Shoulder Pad (Art. III, 8).
Laundry (Art. III, 4, 5).
Ready-made Furniture (Art. III, 3).
Cordage and Twine (Art. VI, 7).
Solid Braided Cord (Art. VI).

Narrow Fabrics (Art. III, 4).
Soft Fibre Manufacturing (Art. III, 4).
Celluloid Button, etc. (Art. III, 10).

X. THE METHOD OF DETERMINING THE CONSUMER DEMAND AND ALLOCATING IT AMONG THE STATES

DISTRICT OF COLUMBIA,

City of Washington, ss:

Edward B. Swanson,* having been first duly sworn on oath deposes and says:

I am a resident of the city of Washington, in the District of Columbia, and am chief economist of the Petroleum Economics Division of the United States Bureau of Mines of the Department of Commerce. I graduated at the University of Washington in 1918, and thereafter for almost 2 years did graduate study in economics in the Robert S. Brookings Graduate School of Economics and Government in Washington, D. C. I have been engaged with the United States Bureau of Mines in work associated with the economic study of the petroleum industry for the past 10 years. Since the latter part of 1922 I have been directly in charge of the Petroleum Economics Division in the Bureau of Mines and for 2 years prior thereto I served as assistant chief of the said division. The Petroleum Economics Division was established in 1925 upon the recommendation of the committee designated by the Secretary of Commerce to study the program of the Bureau of Mines at the time of its transfer from the De-

*This affidavit was introduced in evidence by respondents at the trial before the District Court in the *Amazon* case (No. 260) but was not included in the record on appeal to the Circuit Court of Appeals. Counsel for petitioners in this case have stipulated with the respondents that this affidavit may be presented for consideration by this Court.

partment of the Interior to the Department of Commerce. It was made up of the petroleum unit of the Mineral Resources Division of the United States Geological Survey, dating back to 1882; the petroleum refinery statistics section of the Bureau of Mines, dating back to 1917; and the petroleum portion of Minerals Division of the Bureau of Foreign and Domestic Commerce. Its creation resulted from the consolidation in one unit of work hitherto done in three separate bureaus. Its purpose is to provide current economic data to those interested in the petroleum, natural gas, and allied industries. It prepares and distributes regular and special reports and, by correspondence and otherwise, furnishes information relating to reserves, production, transportation, stocks, consumption, prices, distribution, uses, and marketing of petroleum products and byproducts; refining, transportation and storage facilities; and the economic factors resulting in or influenced by current changes in utilization. This work is done with the view of serving public interest by assisting in coordinating production and manufacturing operations to demand, in promoting efficient distribution, and in assuring ample supplies of petroleum products. The division serves in a consulting capacity to other Government agencies with respect to problems related to oil and natural gas.

My connection with forecasting the amount of crude-oil production required to balance consumer demand began in 1931, when I served as chairman of a voluntary committee on petroleum economics which was designated by the Federal Oil Conservation Board to serve and estimate the approximate crude oil and gasoline supply and demand for the

period from April 1, 1931, to September 30, 1931. The Federal Oil Conservation Board was designated by the President of the United States on December 19, 1924, and was composed of the Secretary of War, the Secretary of the Navy, the Secretary of the Interior, and the Secretary of Commerce. Copy of the letter of the President constituting the Board is marked "Exhibit 1", is attached hereto and made a part hereof. I continued this work as chairman of the said voluntary committee until June 30, 1932. Although my connection with the said voluntary committee ceased at that time, it performed the same work to the close of some time during the year 1933.

The Petroleum Economics Division of the Bureau of Mines first estimated the monthly consumer demand for petroleum products in the United States and the production of crude oil required to balance the consumer demand for such petroleum products for the period from October 1 to November 30, 1933. A similar determination has been made by the said Division for the month of December 1933. This work has been done under my supervision as chief economist of the said Petroleum Economics Division.

The method employed in determining such production has been developed as the result of experience gained in the estimates or forecasts which have been made by the said Petroleum Economics Division and the said voluntary committee and the private agencies during approximately the past 3 years. The method of forecasting the gasoline demand has been developed in the United States Bureau of Mines as the result of a special study extending over a period of almost 2 years. Funda-

mental data employed in making the conclusions entering into such forecasts are the official records of the United States Bureau of Mines. The assembling and analyses of these fundamental data are conducted by members of the staff of the said Petroleum Economics Division, all of whom have had many years experience in assembling and working with information of this character. The work thus performed is done under my direct supervision, and that portion of it pertaining to the interregional movement of gasoline and crude oil, the analysis of trends in refinery operations, and the seasonal fluctuation of gasoline stocks, which result in a forecast of required crude-oil production among the several States is done by me personally.

The seasonal market demand for crude oil in the various producing States in the United States is determined by first ascertaining the total consumer requirements for the principal petroleum products in the United States and then working back to determine the amount of crude oil needed to satisfy this demand for the principal petroleum products and the sources from which it is necessary to obtain this supply. The various steps in this process are hereinafter described.

The consumer demand for petroleum products is determined primarily from a forecast of the probable demand for gasoline during the period for which required production of crude oil is being estimated. Experience has shown that if sufficient crude oil (when checked to meet fuel-oil requirements) is produced to satisfy the demand for gasoline, the demand for the other products of crude oil will be adequately supplied.

The probable domestic demand for gasoline is calculated by multiplying the number of motor vehicles in use by the unit consumption of gasoline per motor vehicle. The method employed in determining the number of motor vehicles which will be in use during the period for which the forecast is being made is based upon a review of new-car and total-car registrations during the period 1925 to 1932, inclusive, the cars in use at the beginning of any year being the total registrations during the year less new-car registrations made during the year. The number of cars to be scrapped during the period is calculated from data on registrations during the 13 years previous, using a formula to determine for the total cars placed in use during each of these years the percentage of which will be scrapped in each succeeding year. By the combination of such data for each of the years, cumulative data are available to show the number of cars of previous year's production which still are in use. The number of cars scrapped each year as determined by the use of the above formula is checked against actual scrapping as determined from car registrations. The formula is adjusted for present economic conditions. The monthly figures on cars in use are distributed on a percentage basis developed from previous experience in monthly fluctuations. From these data the probable number of cars in use during each month of the forecasting period is determined by adding the probable new-car registrations to the probable cars in use at the beginning of the period and subtracting therefrom the probable number of cars to be scrapped during the period.

The calculation on probable cars in use during the forecasting months of 1933 has been checked with actual data covering the first 9 months of the year and the error between the calculated figure and the actual total is twenty-three one hundredths of 1 percent.

The number of motor vehicles in use, determined as above described, is then multiplied by the unit consumption of gasoline per vehicle. This unit consumption figure is determined from data covering the period from 1925 to 1932, inclusive, by dividing the total gasoline consumption each month by the number of motor vehicles in use during the corresponding month and correcting the trend for unusual fluctuations. The calculation shows a straight line trend, deviations from which are in accordance with economic conditions. Such deviations are correlated with the index of business conditions.

The figure for unit consumption of gasoline per motor vehicle is computed on such a basis as will include all of the nonautomotive consumption of gasoline. In other words, the relationship between automotive and nonautomotive gasoline consumption during the past several years has been relatively constant and the method of determining unit consumption, consequently, results in the inclusion of the nonautomotive utilization of gasoline in the figure for unit consumption.

In general it may be said of present conditions that the number of motor vehicles in use is approximately 7 percent less than the number in use 1 year ago, whereas the unit consumption of gasoline per motor vehicle is slightly more than 7 percent higher than it was a year ago. The net result

of offsetting the increase in gasoline consumption per motor vehicle against the decrease in the number of motor vehicles in use results in indicating a slight increase in total motor fuel or gasoline consumption.

The above calculations are made directly under my supervision by Mr. H. A. Breakey, a graduate of Denver University with the degrees of A. B. and M. A. and who has completed at the University of California, Berkeley, Calif., and American University, Washington, D. C., all of the work necessary for the granting of a Ph. D. degree with the exception of the completion of his thesis. In addition, Mr. Breakey was employed for 4½ years during the period 1916 to 1920 by oil companies operating in the Rocky Mountain district.

Through the multiplication of unit consumption per motor vehicle by the calculated number of motor vehicles which will be in use during the period covered by the forecast, there is determined the total quantity of gasoline which will be required for consumption within the United States. This figure is checked through an analysis of trends in domestic gasoline consumption in the territories served by the eight refining districts in the United States which have been employed by the Bureau of Mines in substantially the present form since the assembly and publication of petroleum refinery statistics was begun by the Bureau of Mines. The analysis of such trends is based upon gasoline tax returns during the period 1930 to 1933, to date, inclusive, the consumption in each district being expressed in terms of its percentage to the national consumption. Through the analysis of the relationship between gasoline consumption in each of

the consuming territories, the trend in gasoline consumption in each of the areas is determined. These trends are utilized in checking the total figure as previously determined and also for the purpose of dividing the national consumption into the consumption for each of the districts.

Having thus determined the probable consumption of gasoline in each of the districts, there is then added to the figure for each district the probable export of gasoline from that district during the period. The total of these two sets of figures then represents the total gasoline demand, including domestic requirements and that needed for shipment to other countries and territories.

The total gasoline requirement for each district is then divided into that which will be manufactured at refineries located within the consuming territory and that which will be received from other refining districts. This division is based upon an analysis of trends in the interregional movement of gasoline over the period 1932 and 1933 to date. By making such a calculation for each district and consolidating the requirements thus determined for each producing district, there is determined the quantity of gasoline which should be supplied from each producing district in order to meet the demand in the territory normally served by that district. These figures for regional demands are then adjusted to meet the requirements of normal seasonal fluctuations in stocks of gasoline held at refineries and bulk terminal plants. Through the adjustment of the demand figure with the normal seasonal fluctuation of stocks, there is determined the quantity of gasoline which should be produced within each district, either at petroleum refineries

or from such miscellaneous sources of motor fuel supply as the output of stabilized gasoline at natural gasoline plants or the admixture of benzol.

From the required production of gasoline in each district there is deducted the quantity which will be supplied through stabilized natural gasoline or the admixture of benzol, the remaining figure being the quantity of gasoline which will be required to be manufactured at petroleum refineries within each district. There is then deducted the quantity of natural gasoline which, it is calculated, will be blended with motor fuel produced from crude petroleum in each district. The quantity of natural gasoline is determined on the basis of the recorded operations in each district during the period 1930 to 1933 to date, inclusive. A deduction of the quantity of natural gasoline to be blended from the total gasoline to be manufactured at petroleum refineries in each district determines the quantity of gasoline which is to be manufactured from crude petroleum.

The experience of petroleum refineries during the period 1930 to 1933 to date, as to the relative output of crude petroleum from straight distillation and by cracking, is then reviewed to determine the probable recovery factor which should be employed during the period under consideration to determine the quantity of crude petroleum which necessarily must be refined in order to produce the quantity of gasoline which it has been determined will be required to be produced through the refining of crude petroleum. The application of this factor determines the quantity of crude petroleum which will be needed at refineries in each district.

Data as to the interstate movement of crude petroleum from producing areas to petroleum refineries during the period 1932 to 1933 to date are then reviewed to determine the trends in the establishment of trade channels with respect to the movement of crude petroleum from producing districts to refining districts. The relationships thus determined are then applied to the quantity of crude petroleum which will be required by petroleum refineries in each district and there is thus determined the quantity of crude petroleum which will be required from each producing area to supply the requirement for crude petroleum in each refining district. These calculations are consolidated and there is determined the required production of crude petroleum in order to meet the refining needs during the period under consideration. Data on the exportation of crude petroleum during the period 1932 to 1933 to date are then reviewed to determine the probable export of crude petroleum from each producing district. In a similar manner the records of each producing district are examined to determine the quantity of crude petroleum which will be consumed directly as fuel, burned in field operations, or lost in handling. The probable exports of crude petroleum, together with the probable amount which will be consumed directly as fuel or lost in each district, are then added to the requirements of each district for crude oil for refining. The total of these items thus gives the total crude-oil requirement for each producing district. The data employed are available in such form that these requirements are determined directly on the basis of producing States.

These figures then are finally checked in order to determine the effect of the resulting operations upon the available supply of fuel oil.

In reviewing the data available for the first 6 weeks of the 2-month period with respect to required production of crude oil to balance consumer demand for petroleum products during the period October–November 1933, in comparison with the estimate made by the Federal agency for that period, it has been calculated that the probable error between the actual consumer demand for petroleum products and that estimated will not exceed twenty-five one-hundredths of 1 percent.

The number of barrels of crude oil required to be produced in Texas during December 1933 to meet consumer demand for petroleum products for that month was estimated as follows: Through the calculation, whereby the probable number of motor vehicles in use during the month of December 1933 was multiplied by the unit consumption per motor vehicle, it was found that the domestic demand for gasoline during the month of December 1933 would be 28,242,000 barrels.

Through analysis of trends in regional consumption of gasoline, in each of the refining districts, it was determined that the demand for gasoline in Texas during December 1933 would represent 5.1 percent of the national consumption. The remainder of the national gasoline consumption during December 1933 was divided as follows: East coast 37.2; Appalachian, 4.4; Indiana, Illinois, Kentucky, Michigan, etc., 27.6; Rocky Mountain district, 2.4; and California, 12.6.

By multiplying the national demand of 28,242,000 barrels by the Texas percentage of 5.1, it

was determined that gasoline consumption within the borders of Texas would amount to 1,440,000 barrels. In addition, through the study of recent trends in gasoline exports, it was calculated that gasoline shipments from Texas ports to foreign countries and territories during December 1933 would amount to 563,000 barrels. The addition of the probable exports and the relatively minor addition of 35,000 barrels of gasoline stocks to the figures of probable gasoline consumption within the State of Texas gives the figure of 2,038,000 barrels as the gasoline and motor-fuel requirement within the State of Texas during December 1933. A small portion of this, calculated at 113,000 barrels, will be supplied from stabilized gasoline and other miscellaneous sources of motor fuel. The net gasoline requirement within the State of Texas, determined by the subtraction of the miscellaneous supply from the total motor-fuel requirement, will amount to 1,925,000 barrels.

In addition to supplying the gasoline which will be consumed within its own borders, gasoline produced at refineries located in Texas is shipped to other areas which it provides a portion of the supply necessary to meet the gasoline demand in those areas. Through observance of trends in interregional gasoline movements, it was determined gasoline from Texas to refineries would supply 41.07 percent of the gasoline demand in the east coast region during December 1933. In addition to gasoline shipments to the east coast, gasoline from Texas refineries also is shipped northward into the district comprising Indiana, Illinois, and adjacent States. As part of the examination of interregional gasoline movements, it was determined that gasoline from Texas refineries would supply 13.67

percent of the gasoline demand in the Indiana-Illinois district. Through the application of these percentages to the calculated demand in each of the districts, it was determined that Texas refineries would ship 4,605,000 barrels to the east coast district, and 1,097,000 barrels to the Indiana-Illinois district during December 1933, or a total of 5,702,000 barrels to be shipped to other consuming districts in the United States.

The addition of the shipments of 5,702,000 barrels to the required production to the demand of 1,925,000 barrels within the State of Texas gives the total demand for Texas gasoline during December 1933 of 7,627,000 barrels.

Through an examination of refinery operations, it was calculated that of the 7,627,000 barrels, 431,000 barrels would consist of natural gasoline to be blended at refineries, and that 7,196,000 barrels of gasoline would be produced from crude petroleum. Through the same examination of refinery operations it was determined that the average recovery of gasoline from crude petroleum at Texas refineries during December 1933 would be 44 percent. By the application of this ratio to the required production of gasoline, it was determined that it would be necessary to refine 16,355,000 barrels of crude petroleum at Texas refineries during December 1933, it was determined that 61,000 barrels would be crude petroleum of foreign origin, and 16,294,000 barrels of crude petroleum of domestic origin.

In a similar manner, the required gasoline production in other districts was determined, and the quantity of crude petroleum necessary to provide for the manufacture of the required gasoline was determined. An examination of trends in the

movement of crude petroleum from producing districts to refining districts was made, and as a result it was determined that Texas crude petroleum would supply 84.57 percent of the domestic crude oil required in the east coast district during December 1933, 0.26 percent of the domestic crude petroleum required in the Appalachian district, 3.13 percent of the domestic crude petroleum required in the Indiana-Illinois district, 3.55 percent of the domestic crude petroleum required in the Oklahoma-Kansas-Missouri district, and 60.53 percent of the domestic crude petroleum required in the Louisiana-Arkansas district. Applying these percentages to the quantity of crude petroleum required in each of the districts to which Texas crude petroleum is shipped, it was determined that 9,462,000 barrels of Texas crude petroleum would be shipped to the east coast district during December 1933 and that the total of shipments to the other districts listed would be 3,504,000 barrels.

In addition to these requirements for Texas crude petroleum, it was determined from examination of the records of exports and direct uses of petroleum that 801,000 barrels of Texas crude petroleum would be exported or burned directly as fuel during December 1933.

The summation of these items gives the total of 30,061,000 barrels of *crude petroleum.*

The examination of interregional movements of crude petroleum showed that crude petroleum from Oklahoma, Louisiana, and New Mexico is received within the State of Texas as part of the regular movement of crude petroleum in recognized trade channels. From this study, it was determined that the receipts of such crude petroleum would amount to 2,533,000 barrels. The subtraction of this item

of 2,533,000 barrels from the total required, 30,-061,000 barrels, gives the figure of 27,528,000 barrels as the required production of Texas crude petroleum in order to meet consumer demand for petroleum products during December 1933. That amount divided by 31 days in December gives 888,000 barrels daily.

A review of the natural and normal markets served by crude petroleum and petroleum products from each of the producing districts during the years 1931 to 1933 to date, indicates that the required production of Texas crude petroleum is equal to the domestic crude-oil requirements of Texas and east coast refineries. There are other interregional movements from and to Texas, but such movements tend to offset one another, with the result that a definite check as to the accuracy and reasonableness of the calculations may be made by a comparison of the required Texas crude-oil production with the domestic crude-oil requirements of Texas and east coast refineries. The domestic crude-oil requirements of Texas refineries, 16,-294,000 barrels, plus the domestic crude-oil requirements of east coast refineries, 11,188,000 barrels, gives a total of 27,482,000 barrels. The required Texas crude-oil production, as calculated in the manner described during December 1933, amounts to 27,528,000 barrels, which provides the necessary check as to reasonableness and accuracy.

In the calculations, according to the method employed, the study of trends in regional distribution and refinery operations is continued currently so as to include most recent data available in order that such recent changes may be reflected in the factors employed in determining the influence of each on the interregional movement of crude pe-

troleum, of gasoline, and to recovery of gasoline from crude petroleum. According to this method, the current changes are determined from the statistical data employed and are reflected in the results of the calculation.

Through the same method of calculation the production of crude oil required in other oil-producing States to meet consumer demand was estimated.

The following is a statement of the production, refining, consumption, etc., of petroleum and the refined products thereof, in the State of Texas, and the exports and shipments to other States of petroleum and refined products thereof from the State of Texas for the year 1932, such statement being based upon official figures and data in the Bureau of Mines which I believe to be accurate.

Supply and demand of petroleum and products thereof in Texas in 1932

[Figures in Barrels]

Supply within Texas:	
Production of crude oil	312,478,000
production of natural gasoline	8,836,000
Imports of crude oil [1]	945,000
Receipts of crude oil from other States [1]	23,353,000
Decrease in stocks of crude oil and refined products	15,137,000
Total demand for Texas oils	360,749,000
Demand within Texas:	
Gasoline	17,883,000
Lubricants (3 percent of above)	
Gas, oil, and fuel oils (1931): [2]	
Railroads	[3] 17,144,000

[1] Imports and receipts from other States of refined products are negligible.

[2] No figures for gas, oil, and fuel-oil consumption in Texas for 1932 are available, but the 1932 figures will closely approximate the 1931 figures.

[3] Total deliveries to railroads, some portion of which, possibly 20 percent (3,428,000 barrels) is actually used outside of State.

Demand within Texas—Continued.		
Gas, oil, and fuels oils (1931)—Contd.		
Steamships	[4] 12,483,000	
Other	[5] 16,518,000	
		46,145,000
Other refined products		[6] 23,564,000
Crude as such plus losses		1,221,000
Refining losses		5,233,000
Total demand within Texas		94,582,000
Shipped from Texas:		
Exports:		
Crude	7,680,000	
Refined products	21,684,000	
		29,364,000
Deliveries to other States:		
Crude	143,170,000	
Refined products	93,633,000	
		236,803,000
Total shipped from Texas		266,167,000
Total demand for Texas oils		360,749,000

Summary

Oil used within Texas	94,582,000 barrels, or	26 percent
Oil shipped out of Texas	266,167,000 barrels, or	74 percent
Total	360,749,000 barrels, or	100 percent

To arrive at a fair figure for the percentage of Texas oil which is consumed outside of Texas as against the total consumption of Texas oil by consumers other than the oil industry, the following deductions from the figures for demand within Texas are reasonable and proper:

Oil delivered to ships at Texas ports for bunker fuel	12,483,000
Oil consumed by the oil industry in production and refining of petroleum	14,284,000
Refinery losses	5,233,000
Total deduction	32,000,000

[4] Delivered at Texas ports for bunker fuel—all consumed outside of Texas.

[5] Of this amount 14,284,000 barrels are consumed in the production of, and refining of petroleum.

[6] Some minor refined products such as kerosene, asphalt, etc., included in this figure, leave Texas possibly as much as 15 percent of the total, which would amount to 3,535,000 barrels.

The fuel oil delivered to railroads within Texas and consumed outside of Texas (footnote 3 above) and the kerosene, asphalt, etc., which leave Texas (footnote 5 above) which together total almost 7,000,000 barrels are not deducted above because of uncertainty as to exact quantity.

With this modification of the foregoing tabulation "Supply and demand of petroleum and products thereof in Texas in 1932", the following summary is true:

Oil used within Texas by consumers other than the oil industry	62, 582, 000 barrels, or	18 percent
Texas oil used outside of Texas	278, 650, 000 barrels, or	82 percent
Total	341, 232, 000 barrels, or	100 percent

The monthly statistics of the Bureau of Mines assembled for the first 8 months of 1933 do not indicate that any material change has occurred during the present year in the percentages of oil used within Texas and Texas oil used outside of Texas.

EDWARD B. SWANSON.

Subscribed and sworn to before me this 9th day of December 1933.

[SEAL] FRANK JONES.

My commission expires January 10, 1933.

U. S. GOVERNMENT PRINTING OFFICE: 1934